Vol. XII, Nos. 1—4 January—December 1960

Complimentary Copy

DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE
MINISTRY OF FOOD AND AGRICULTURE, DEPT. OF AGRICULTURE
GOVERNMENT OF INDIA

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22 OCT 1964
SERIAL SEPARATE As. 129

PLANT PROTECTION BULLETIN

Science in Practice

Issued by the
Plant Protection Adviser to the Government of India
NEW DELHI

1964.

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DPP.2.XII.1-4
500.

Published in a single combined issue

Sale Price : (Inland) *Rs.* 3.00 (Foreign) 7*s.* or $1 8 *cents*

Available from

THE MANAGER OF PUBLICATIONS, CIVIL LINES, DELHI—8

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NASIK AND PUBLISHED BY THE MANAGER OF PUBLICATIONS DELHI-6
1964

NOTE

This Bulletin is intended to disseminate information about plant protection measures and campaigns adopted or conducted in different parts of India as well about the advances made in the field of plant protection in other parts of the world, to the extent possible. It is also intended to give information about the latest developments in the production of pesticides, plant protection equipment and techniques of pest and plant disease control. Elaborate scientific papers on Entomology or Plant Pathology or on the chemistry of pesticides would normally not be in place in this Bulletin but short notes dealing with the behaviour or distribution of pests and plant diseases and brief notes on their epidemiology, control, etc., would be welcome.

Manuscripts submitted for publication in this Bulletin must be typed in double spacing on one side of the paper only, leaving ample margin on the left, at the bottom and on the top of the page. Photographs or drawings should be reduced to the minimum number possible and must be accompanied by a clearly typed legend which should appear under them. In addition, they should bear on their reverse in clear handwriting in pencil the name or names of the author or authors and the article which they illustrate. While this Directorate will take every care to include only such material in this Bulletin as may be considered reasonably correct and useful, it can accept no responsibility for every statement made and every opinion expressed.

Due to various unavoidable reasons, the appearance of this Bulletin has been far behind the scheduled time. While this must be greatly regretted, every effort would be made to avoid delays in future. Those who may read this Bulletin are invited to offer criticisms and suggestions for its improvement.

SARDAR SINGH,
PLANT PROTECTION ADVISER TO
THE GOVERNMENT OF INDIA.

New Delhi

Abst. 332

CHEMICAL CONTROL OF APHIDS ATTACKING POTATOES WITH SOME NEWER INSECTICIDES

By

SARDAR SINGH* & M. S. GURAM,
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In Punjab, aphids (*Myzus persicae* Sulz and *Aphis gossypii* Glover) on potatoes are usally considered minor pests. However, they appeared in an epidemic form in Jullundur and other potato-growing tracts of Punjab over vast areas in February-March, 1960. inspite of dry, clear and comparatively hot weather. They are small. plump and yellowish green sucking insects which multiply asexually by producing living young ones at a rapid rate and pass through several generations during the year. The pest is most active during December-April. The colonies of aphids of all the stages suck the sap from the leaves, growing shoots, stems and flowers. The damage inflicted is, therefore, very severe and often results in failure of the crop. They transmit virus diseases like leaf rot and mosaic.

Before the advent of modern synthetic insecticides, tobacco decoction, nicotine sulphate (spray and dust), rosin compound and fish oil soap were mainly used for the control of this pest, Rahman (1939), Batra (1953), and Narayanan (1954). Basheer (1958) recommended ethyl parathion 0.025% and mesopestox 0.03% against aphids. Sen (1958) tried ethyl parathion 0.02% and endrin 0.02% for the control of this pest. Singh & Sidhu (1958 and 1959) tried BHC 0.25% suspension, diazinon 0.025%, endrin 0.02% and parathion 0.02% emulsions against mustard aphid. Sohi & Guram (1960) used ether extract emulsion 0.75% of sweet flag root. Pradhan, Jotwani & Sarup (1960) found pestox 0.1%, parathion 0.05%, diazinon 0.05% and *gamma* BHC 0.1% to be fairly effective against mustard aphid.

Results of two replicated field trials carried out with various insecticides on aphids attacking potatoes at a model farm near Jullundur, during the year, 1960 are reported below :—

The two experiments were laid out at the farm of S. Iqbal Singh in the first week of March, 1960. The plot size was kept at 1/160th acre and a two feet wide bund between every two plots served as buffer. There were thirteen (six chlorinated hydrocarbon, six phosphatic insecticides and one control) treatments (randomised block system) and four replications and the spray material was used @ 60 gallons per acre. Spraying operations were carried out with a fine nozzled rocking sprayer (Gator). Population of aphid adults and numphs per unit of 25 leaves (5 leaves on five plants selected at random) was recorded both 24 hours before spraying as well as 48 hours after

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spraying. Data regarding per cent mortality were corrected according to Abbet's formula before being transformed into angular degrees for statistical analysis. The same is summarised in table 1.

TABLE I

Percentage mortality of aphids (average of four replications)

	Experiment I		Experiment II	
Date of application	1-3-60.		2-3-60.	
Date of observation	3-3-60.		4-3-60.	
Treatment	Mean %age mortality	Degrees angular transformation	Mean %age mortality	Degrees angular transformation
Rogor emul. 0.02%	93.9	75.8	94.2	76.1
Rogor emul. 0.025%	96.0	78.5	96.9	79.9
Rogor emul. 0.03%	98.7	84.2	97.1	80.5
Phosdrin emul. 0.02%	91.6	73.4	89.8	71.4
Phosdrin emul. 0.025%	97.0	80.3	96.5	79.3
Phosdrin emul. 0.03%	97.7	81.4	97.0	80.2
Phosdrin-endrin emul. 0.025%	88.1	69.8	87.6	69.4
Phosdrin-endrin emulsion 0.03%	92.0	73.7	92.1	73.7
Endrin emul. 0.025%	80.9	64.1	80.8	64.0
Diazinon emul. 0.025%	96.4	79.1	96.8	79.9
Ethyl parathion emul. 0.025%	98.9	84.2	98.7	83.9
BHC suspension 0.25%	82.5	65.3	81.7	64.7
C.D. at 1%		2.72		2.49
C.D. at 5%		2.077		1.90

It will be seen that all the treatments except endrin emulsion 0.025% gave significantly better kill than BHC 0.25% suspension Ethyl parathion 0.025%, rogor 0.03% and phosdrin 0.03% emulsions proved significantly superior to others.

Discussion

The degree of control obtained with tobacco decoction, rosin compound and fish oil rosin soap, recommended before the advent of the chlorinated hydrocarbon/phosphatic insecticides, was rather low. Recently, several organic synthetic insecticides have been used by various workers. Basheer (1958) recommended the use of ethyl parathion 0.025% and mesopestox 0.03% as most effective against this pest. Singh and Sidhu (1958 and 1959) tried BHC 0.25% suspension, endrin/diazinon 0.025% emulsions and parathion 0.025% suspension successfully for the control of mustard aphid.

In the present trials carried out with various insecticides, *viz.* rogor emulsion 0.02%, 0.025%, 0.03%, phosdrin emulsion 0.02%, 0.025%, 0.03%, phosdrin-endrin emulsion 0.025% and 0.03%, endrin emulsion 0.025%, diazinon emulsion 0.025%, ethyl parathion emulsion 0.025% and BHC suspension 0.25% gave 94.1, 96.4, 97.9, 90.7, 96.7, 97.3, 87.8, 92.0, 80.8, 96.6, 98.8 and 82.1 per cent mortality (on the basis of average of eight replications) respectively. Results obtained with ethyl parathion, endrin, diazinon and BHC are in line with the work of the several workers referred to above. Rogor, phosdrin and phosdrin-endrin emulsions have proved very effective. Ethyl parathion 0.025%, rogor/phosdrin 0.03% emulsions are the insecticides of choice. Their use @ 2.3 ozs., 2.9 ozs., & 2.9 ozs. technical material per acre costing Rs. 6.87, Rs. 7.20 and Rs. 7.83 respectively (see table 2) is recommended for the control of aphids attacking potato crop.

Summary

Aphids (*Myzus persicae* Sulzer & *Aphis gossypii* Glover) appeared on potatoes in epidemic form at Jullundur, the premier potato growing region of Punjab, in the spring of 1960. Various concentrations of six chlorinated hydrocarbons and phosphatic insecticides were tried in the first week of March in two experiments with four replications each in randomised blocks (13 plots of I/160 acre in each) to work out the most effective and economical insecticides which could be recommended to the growers for the control of aphids.

The phosphatics: ethyl parathion, rogor, phosdrin and diazinon at 0.025% emulsions @ 60 gallons/acre gave over 96% mortality as compared to over 80% mortality with endrin 0.025% emulsion and BHC 0.25% suspension. The cost of insecticides in the case of the phosphatics worked out at Rs. 6.87, Rs. 6.00, Rs. 6.52 and 7.50 respectively and it was Rs. 5.12 and Rs. 3.18 in case of endrin and BHC.

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Table 2

Comparative cost of different insecticides

Sl. No.	Commercial formulation used	Dilution tried	Quantity of material used per acre		Price per lb. commercial formulation	Cost per acre
			Technical	Commercial		
1	2	3	4	5	6	7
					Rs.	Rs.
1.	Rogor emulsion concentrate 40%	0.02%	1.92 oz.	4.8 oz.	16.00	4.80
2.	Rogor emulsion concentrate 40%	0.025%	2.40 ,,	5.0 ,,	16.00	6.00
3.	Rogor emulsion concentrate 40%	0.03%	2.88 ,,	7.2 ,,	16.00	7.20
4.	Phosdrin emulsion concentrate 20%	0.02%	1.92 ,,	9.6 ,,	8.70	5.22
5.	Phosdrin emulsion concentrate 20%	0.025%	2.40 ,,	12.0 ,,	8.70	6.52
6.	Phosdrin emulsion concentrate 20%	0.03%	2.88 ,,	14.4 ,,	8.70	7.83
7.	Phosdrin Endrin emulsion concentrate 20%	0.025%	2.40 ,,	12.0 ,,	7.50	5.12
8.	Phosdrin Endrin emulsion concentrate 20%	0.03%	2.88 ,,	14.4 ,,	7.50	6.75
9.	Endrin emulsion concentrate 20%	0.025%	2.40 ,,	12.0 ,,	7.50	5.12
10.	Diazinon emulsion concentrate 20%	0.025%	2.40 ,,	12.0 ,,	10.00	7.50
11.	Ethyl parathion emulsion concentrate 46.7%	0.025%	2.34 ,,	5.0 ,,	30.00	6.87
12.	BHC W.D.P. 50% .	0.25%	1.50 lb.	3.0 ,,	1.06	3.12

IMPORTANCE OF PLANT QUARANTINE AGAINST TOBACCO MOTH

By

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Introduction

India is one of the important tobacco growing countries of the world. Although the annual production of tobacco in this country has been fluctuating during the last two decades or so (the production during the triennium ending 1958 was only 630 million lb. as against 758 million lb. during the triennium ending 1939). India continues to be the third most important tobacco growing country, the first two being U. S. A. and China. The share of tobacco in the total value of agricultural production is not much but the tobacco crop is the mainstay of agriculturists in certain areas, where tobacco production is concentrated. Tobacco brings to the Indian growers an annual income of about Rs. 49 crores, earns foreign exchange to the country of the order of Rs. 15 crores and also yields Excise Duty, Agricultural Cess and Customs Revenue of the value of Rs. 50 crores per year*. These figures indicate the importance of the tobacco crop in India's agricultural economy.

Unmanufactured tobacco is an important commodity exported from India to various countries, notably U.K., China, U. S. S. R., Belgium, Luxembourg and France. The largest share of exported tobacco comes from Andhra Pradesh. Small quantities of unmanufactured tobacco are being imported into India to meet the special requirements in the manufacture of certain brands of high class cigarettes, cut cigarette tobacco and cigars. These imports come mostly from U. S. A., some quantities are also being imported from Ceylon. Virginia tobacco is imported from U. S. A. under the PL 480 programme where as chewing tobacco (Jaffna tobacco) has been coming under an Indo-Ceylon Trade Agreement.

The tobacco moth

The tobacco moth, *Ephestia elutella* Hubner is a serious pest of cured tobacco in various countries but, fortunately, it is not known to occur in India, although another important pest of stored tobacco, *Lasioderma serricorne* Fb. occurs here. *E. elutella* is more or less cosmopolitan in distribution and has been reported from all the major tobacco growing countries of the world except India. It attacks not only tobacco but also cereals and cereal products, oil seeds, animal food staffs, dried fruits, cocoa beans, nuts and various other commodities.

**Marketing of tobacco in India*. Agricultural Marketing Series, issued by Agricultural Marketing Adviser to the Government of India, Nagpur, 298 pp.

Quarantine regulations in India

Under the rules for regulating the import of plants and plant materials into India under the Destructive Insects and Pests Act 1914, unmanufactured tobacco cannot be imported into India except through the seaports of Bombay, Calcutta, Cochin, Madras, Trivandrum and Visakhapatnam and the airports of Santa Cruz (Bombay), Dum Dum (Calcutta), Meenambakam (Madras) and Palam & Safdarjung (New Delhi) and unless accompanied by an official phytosanitary certificate with the additional declaration that it is free from any stage of the tobacco moth or that the pest does not occur in the country of origin. Consignments of unmanufactured tobacco not exceeding 10 kilograms in gross weight may be imported by air, provided they are packed in a manner which will not allow insects to enter into or escape from the package. Unmanufactured tobacco shall be inspected and, if necessary, fumigated or otherwise treated on arrival by the Plant Protection Adviser to the Government of India or any person duly authorised by him in this behalf on payment of fumigation or treatment fee, which is Rs. 6 per consignment for 1.5 cubic metre or less and Rs. 2 for every additional 1.5 cubic metre or part thereof. Consignments not exceeding 10 kilograms in gross weight shall be fumigated or otherwise treated without the payment of the fee. Unmanufactured tobacco cannot be imported by letter or sample post.

Unmanufactured tobacco intended for other countries shall be allowed transit into India or transhipment at any of the seaports mentioned above. Sample consignments of unmanufactured tobacco coming by air and intended for other countries shall be allowed transit through India or transhipment at any of the airports mentioned above, if such consignments are packed in a container in such a way as not to allow insects to enter into or escape from them and the containers are not to be opened in any part of India. The term 'unmanufactured tobacco' includes raw as well as cured unmanufactured tobacco.

In view of the fact that the tobacco moth is a serious pest in all the major tobacco growing countries except India and of the danger of introduction of this pest along with imported tobacco, the question of introducing compulsory fumigation of all imported unmanufactured tobacco has been under the consideration of the Government of India. We have a system of compulsory fumigation of all imported American and West Indies cotton aimed at preventing the introduction of the notorious Mexican Boll Weevil (*Anthonomus grandis* Boh.) and if similar quarantine measures are enforced in respect of imported unmanufactured tobacco, our tobacco industry will not face the menace of this pest. The other tobacco growing countries of the world do not face this problem as India does, because the pest already occurs in them and therefore there is no compulsory fumigation of unmanufactured tobacco. Nevertheless, in some of these countries fumigation of imported, unmanufactured tobacco has been recommended by official and non-official agencies and is carried out as a routine measure.

In U. S. A., for example, all imported Turkish and Greek tobacco is fumigated before being placed in store. In some countries the import of unmanufactured tobacco is subject to certain statutory restrictions. In Southern Rhodesia unmanufactured tobacco including commercial samples cannot be imported, except by air or under the direct supervision of the Department of Agriculture and subject to such precautionary measures as may be considered necessary and to the issuance of a permit. This restriction is being imposed because of the danger of introduction of the Blue Mould disease of tobacco. In Egypt all consignments of plants and plant materials which are found at the port of entry to be infested by any species of *Ephestia* or any one or more of certain other pests are compulsorily fumigated at the expense of the consignee before being allowed into the country. Consignments requiring fumigation and arriving at any port, which is not properly equipped for the purpose, are reshipped at the expense of the consignee to a port where fumigation facilities are available. In the Republic of Ireland unmanufactured tobacco is admitted only if imported in compliance with the conditions of a licence obtained in advance from the Revenue Commissioners.

As the imports of unmanufactured tobacco under PL 480 are expected to increase in the coming years, the need for enforcement of adequate preventive measures against the tobacco moth has assumed much greater importance than hitherto. The tobacco moth is catholic in its taste and can infest many varieties of agricultural commodities, as already mentioned and once it is introduced into the country, it can very easily spread because of its food habits and it would be very difficult to eradicate the pest. It is worth recalling that the tobacco moth was not known to be a pest of tobacco in England until 1929, when a sudden and serious outbreak appeared on imported Rhodesian tobacco, large stocks of which had accumulated in the warehouses in 1927, 1928 and 1929 as a result of heavy imports following a rebate in the import duty allowed under what was known as the Imperial Preference Tariff. Such indirect, but serious consequences of new or revised trade and tariff policies have to be foreseen and suitable remedial measures taken if plant quarantine is to be successful in any country

CONTROL OF WATER HYACINTH WITH FORMULATIONS OF 2, 4-D IN BHARATPUR (RAJASTHAN)

By

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Large stretches of water in India are infested with water hyacinth, particularly in Uttar Pradesh, Bihar, Assam, Orissa and Manipur. The first author who has been frequently travelling in the states of South India has noted that the area infested with this weed there, is progressively increasing. Because of favourable climatic conditions and if timely control measures are not undertaken, the weed could become a greater menace there than in the north India. Many workers in India (Joshi *et al* 1950) have reported on the efficacy of 2, 4-D for the control of this weed. In most cases the experimental work was undertaken on small areas by using sodium salt of 2, 4-D and the drying of plants was considered as its complete death. There is no evidence of critical work in India on the lines undertaken in the U.S.A. where this weed is a serious menace in the Southern States. A perusal of literature on the subject shows that (i) amine salts of 2, 4-D are much more effective than sodium salt; (ii) a plant may dry even when 2, 4-D is applied at relating low dosage but there is subsequent regeneration by production of offsets from apparently dead plants and (iii) for effecting eradication, the dry plants must sink quickly so that they may decay completely and the period of sinking is known to be dependent on the total quantity of weedicide (acid equivalent) applied per unit area (Eggler, 1953). The importance of the last aspect will be appreciated when it is realised that 10 plants introduced in a pond are known to become 6,50,000 in one year sufficient to cover one acre (Penfound & Earle, 1948). Any control treatment which leaves room, for regeneration of the weed, even to the smallest extent, will nullify the eradication programme.

The opportunity to conduct trials with various formulations of weedicides based on 2, 4-D and different dosages of the same arose out of a recommendation of the Sixth meeting of Executive Committee of Indian Board of Wild Life which met at Sivapuri (Madhya Pradesh) in 1959. It was reported that the importance of the famous bird sanctuary of the Keola Deo Ghana lake at Bharatpur was threatened by the menace of water hyacinth.

The Ghana lake sanctuary covers an area of about 11 sq. miles, of which about 50 per cent remains under water only for five months. It was gathered that early in 1950 some water hyacinth plants were introduced to check the evaporation and by 1959 the infestation had spread over 3,000 acres. As the infested area increased progressively, the ducks visiting the lake diminished perceptably. The only way to restore the original position, was by cleaning the lake of the weed.

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Prior to any large scale operation, some preliminary trials become necessary and the results are reported in this paper.

The experiments were undertaken on the outer moat which surrounds the Bharatpur fort. The moat channel is six miles in length and 100-150 feet wide, broken up into many compartments some of which become dry after the rains and the others retain water throughout the year upto a depth of 4 to 6 feet. The spraying operations were undertaken from both sides of the moat with a power sprayer (high volume) by using 60 gallons of spray fluid per acre. Sodium salt of 2, 4-D (Fernexone—an I. C. I. product) and Dithyloamine salt of 2, 4-D (Hedonal—a Bayer Agro. Chem. product) were used in the trials. These were applied at the following rates and each dosage was replicated twice. The spraying operations were undertaken between the 13th to 17th October and were repeated between 24th to 26th October. 1959.

Sodium Salt of 2, 4-*D.*

1 lb. acid equivalent per acre tested on 6 acres.

3 lb. acid equivalent per acre tested on 4 acres.

Amine salt of 2, 4-*D.*

1 lb. acid equivalent per acre tested on 4 acres.

2.45 lb. acid equivalent per acre tested on 4 acres.

(i) Results of observation after one week of first spraying.

(1) Sodium salt of 2, 4-D (2 lb. a.e.). The leaves dried up partially within a week of the first spraying but the petioles were green.

(2) Sodium salt of 2, 4-D (3 lb. a.e.). The leaves dried up completely but petioles retained green colour in patches.

(3) Amine salt of 2, 4-D (1 lb. a.e.). The effect was comparable to (2).

(4) Amine salt of 2, 4-D (2.4 lb. a.e.). The effect was very pronounced; both the leaves and majority of the petioles had lost their green colour.

(ii) Results of observation after three weeks of first spraying:

The sprayed plots were examined once again in the third week of December, 1959 to study the effect of various dosages of weedicides after two applications on sinking and regeneration of plants. Unfortunately the water had dried up in most parts except the centre. However, it was obvious that there was no sinking of plants in either of the treatments (1) to (3) and regeneration had commenced. The latter was little in (2) and practically nil in (4). The texture of dried up plants left on the ground was examined. In treatment (1) and (3) the floats (spagy tissue) on the petioles were still turgid, in (2) it had partially collapsed and in (4) completely so. Only in the last treatment the plants had completely disintegrated and crumpled to a powdery mass. This is taken as an indirect evidence of sinking of dead plants and this is corroborated by collapsed and rotting floats on the petioles.

The total cost per acre (including weedicide, P. O. L., hire charges of sprayer) for two spraying with Sodium salt of 2, 4-D (3 lb. a.e.) was Rs. 23.00 and with amine salt (2.75 lb. a.e.) Rs. 32.00 per acre respectively.

Later on a major portion of heavily infested area in the Ghana lake was cleared of the weed by the Forest Department of the Rajasthan Government, both by use of sodium salt of 2, 4-D and manual labour and a detailed account of the same has been published by Sen (1957). The paper also reports that the treatment with chemical did not kill the fishes.

Conclusions and Suggestion

The climatic conditions of Bharatpur could be considered as generally representing the northern plains of India. It was found that two sprayings with amine salt at the rate of 2.5 lb. per acre each time (an acid equivalent) resulted in complete kill and sinking of plants within about 3 weeks. Such was not the case with the lower concentration of the formulation nor with low and high concentrations of sodium salt. In the U. S. A., it has been noted that the period of sinking is differently influenced by the dosage of amine salts in various southern states and for each the dosage may thus be different. Similar critical studies need to be undertaken in various states of India.

The eradication of water hyacinth would make large areas available for growing water nut (*Trapa bispinosa*) as a subsidiary food and also for promoting fish culture and cultivating deep water paddy. The authors were informed that a few years back the outer moat in Bharatpur was extensively cultivated with water nut. F. Botke*, an Inland Fisheries Expert of the F. A. O. while working in West Bengal in 1952-53 reported that by spending about Rs. 110 to 150 per hectare in eradicating water hyacinth with 2, 4-D, the annual fish production was expected to increase by about 400 kilogram per hectare worth about Rs. 450.

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*Report No. 226 TA-272/S/6 Project India/9. Rome, Feb., 1954.

CONTROL OF BIRDS BY MECHANICAL BIRD SCARER

By

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and

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Birds constitute a serious menace to food grains and fruit production in India. They spoil much more than what they eat. Control of birds is not an easy problem and in an effort to minimise damage, about half a dozen different methods are adopted, of which the use of mechanical bird scarer is one.

Bird scaring techniques in India such as planting of a dummy human figure in the middle of fields or throwing stone at the birds by means of a piece of rope or bow or beating empty containers and shouting or making sound by explosion of gun powder, are age old and commonly practised. In all these methods, excepting the first one, human labour is required for conducting the job. As in other agricultural operations, generally the farmer himself or his family provides the labour for scaring the birds and therefore, the above methods of protecting the crop do not cost him anything by way of labour charges or it is very nominal. In orchards the control of birds is not possible from any one place as in the case of field crops by building a temporary *machan* or platform. Therefore, it becomes necessary for the farmer to hire labour to keep watch over the trees as he alone or his family cannot manage to scare the birds all over the area. The manual methods of scaring birds are labourious since they require to be enforced for all the 24 hours to be effective. Practically it is not possible and more so in the case of hired labourers and therefore, these methods are less effective, besides being expensive over large areas.

In place of manual methods of scaring birds, mechanical devices producing loud reports at regular intervals are also used. Mechanical bird scarers as they are called, work on carbide and the sound produced by them has the same effect on birds as explosion of gunpowder. They are used in large numbers in Europe and America in the fields and also in orchards. The only discernible advantage in the mechanical bird scarer is that it produces sound automatically at regular intervals and does not require continuous attendance.

With a view to testing mechanical bird scarers for their efficiency under Indian conditions, an Indian make—'Protokrop' and a German make 'Purivox'—were tried first in an orchard of loquat and guava at Delhi in 1958 and 1959, respectively. Encouraged by the results another test was made in *bajra* field at Delhi in 1959, with the Indian

make Protokrop machine. The results of all the three tests are given here to give a fair idea of the performance of the mechanical bird scarer in the orchard as well as in the field.

Test and trail with Protokrop mechanical bird scarer in orchard

The trial was conducted in an orchard in Haiderpur village in Delhi. It lasted for 35 days, from 15th February, 1958 to 20th March, 1958. The area of the orchard was 7.5 acres and contained trees of loquat, *ber*, pomegranate, mango, papaya, guava, banana and *kamrakh* (*Averrhoa carambola*). Only loquat and *ber* were fruiting at the time of trial. In this particular orchard parrots (*Psittacula krameri*) jungle babbler (*Turdoides serricolor terricolor*), tree pie (*Dendrocitta vagabunda*), crows (*Corvus macrorhynchos*) and sparrows (*Passer domesticus*) amongst the birds were observed to damage the fruits during the day and flying foxes during the night.

The machine was kept over a platform built (25 feet above the ground) on a loquat tree situated in the centre of the orchard. It was worked every day from 5.30 A.M. to 10.10 A.M. and 4.00 P.M. to 8.40 P.M. for scaring birds and 12.00 P.M. to 4.40 A.M. for scaring flying foxes. In all, the mechanical bird scarer was operated for about 13½ hours per day.

The consumption of calcium carbide was 3 lb. per day of 13½ working hours, costing about Rs. 1.50 (@ 0.50 nP. per lb.). The machine was adjusted in the beginning to give 38 to 44 reports per hour and throughout the period of the trial it continued to give the same number of reports.

Observations

As judged by the quantity of damaged fruits and visits of the birds upon the fruit trees, an area of 3.2 acres was effectively protected by one mechanical bird scarer. There were 83 loquat trees in fruiting stage spread over this area. Before conducting the trial, fruits damaged by birds and flying foxes were collected in the orchard every day for a few days and it was noted that on an average 1 lb. of loquat fruits were falling per tree per day. The damage was noticed in spite of the four labourers employed by the farmer for bird scaring. This damage was however, reduced to an average of ¼ lb. per tree per day after the mechanical bird scarer was put into operation in addition to the labourers. On an average, there was thus a saving of ¾ lb. of fruits per tree per day due to mechanical bird scarer. The economics of the control operation has been worked out on the basis given above.

Economics of control operation

Cost of running the mechanical bird scarer

Cost of 105 lb. calcium carbide (@ 3 lb. per day for 35 days)	=	Rs. 52.50 nP. (@ Rs. 0.50 nP. per lb.)

Cost of fruits saved on account of the mechanical bird scarer

Quantity of fruits saved per day on 83 trees	=	62 lb. (@ ¾ lb. per tree)
Quantity of fruits saved during 35 days	=	2,170 lb.
Cost of 2,170 lb. loquat fruit (@ 0.12 nP. per lb. at whole sale price)	=	Rs. 271.25 nP.

Profit as a result of savings in fruit damage through the mechanical bird scarer, therefore, works out to Rs. 218.75. The cost of a Protokrop mechanical bird scarer is Rs. 187.50 nP. and it pays the farmer Rs. 31.25 nP. in the first year in addition to its own cost.

Test and trial with Purivox mechanical bird scarer in orchard

The trial was conducted in a guava orchard in the village Sahipur in Delhi from 15-1-1959 to 31-1-1959 (16 days). The area of the orchard was 5.5 acres. In this orchard birds like parrots, sparrows, crows, tree pie, jungle babbler and *bulbul* (*Molpastes cafer*) were observed to damage guava fruits.

Purivox mechanical bird scarer was hung from a branch of a tall guava tree in the centre of the orchard. Throughout the period of the trial it was operated from 6.30 A.M. to 11.00 A.M. and then from 3.30 P.M. to 7.15 P.M., in all for 8 hours and fifteen minutes in a day. The machine consumed 1¾ lb. calcium carbide per day, costing Rs. 0.87. @Rs. 0.50 nP. per lb.). Before starting the trial, the machine was adjusted to give 25-32 reports in an hour.

Observations

Birds on 214 trees over an area of 3.5 acres were observed being driven away by sound produced by the Purivox machine. This was also confirmed by the reduction in the quantity of fallen fruits damaged by birds in the area protected by the mechanical bird scarer.

The bird damage to guava fruits prior to the period of trial was on an average 3¾ maunds per day in the orchard. During the period of trial the bird damaged fruits weighed 2¼ mds. per day on an average. Thus 1½ mds. of fruits were saved per day due to the mechanical bird scarer. In this case, the saving in fruits has not been substantial perhaps because no labourers were kept by the farmer for driving away the birds from the trees in addition to the mechanical bird scarer as in the previous trial.

Economics of control operation

Cost of running the mechanical bird scarer

Cost of 28 lb. calcium carbide (@1¾ lb. per day for 16 days)	=	Rs. 14 (@ 0.50 nP. per lb.)

Cost of guava fruits saved on account of the mechanical bird scarer

Quantity of fruit saved per day	=	1½ mds.
Quantity of fruit saved in 16 days	=	24 mds.
Cost of 24 mds. of fruit (@ Rs. 7.00 per md. at whole sale price)	=	Rs. 168

According to the above calculation, the gain through the mechanical bird scarer is Rs. 154 in a period of 16 days only. A Purivox mechanical bird scarer costing about Rs. 200 can, therefore, save guava fruits from birds much more than its value in one season.

Test and trial with Protokrop mechanical bird scarer in field

The trials were carried out in a *bajra* field at Todar Farm, Najafgarh, Delhi, from 14-9-1959 to 7-10-1959 (24 days) during the period when the birds damage the crop. The area of the farm was 10 acres and the birds that damaged *bajra* crop in this farm were parrots, crows, sparrows, pigeons (*Columbaliva*) and jungle babbler. The machine was operated 10½ hours per day from 5.00 A.M. to 11.00 A.M. and 3.00 P.M. to 7.30 P.M , which was the visiting time of the birds in the fields in flocks although they visited the fields at other time also during the day but their number was very small . Throughout the trial period, the machine was adjusted to give 30 to 40 reports in an hour. It was kept in the centre of the 10-acre *bajra* crop over a platform made of bamboo sticks so as to reach upto the level of the *bajra* plants.

The object of the trial was:—

1. To investigate the efficacy of the mechanical bird scarer for the purpose of scaring the birds from the fields.
2. To find out the area effectively covered by one mechanical bird scarer.
3. To work out and compare the economics of working mechanical bird scarer with that of manual bird scaring technique.

In this trial, the efficacy of the mechanical bird scarer was compared with the common method of scaring birds by throwing stones by means of a rope and shouting, which was being conducted in an adjoining field outside the Todar Farm and with control field, where nothing was being done to scare away the birds. Observations on the number of *bajra* ears damaged by the birds were recorded over 1/10th of an acre, selected at random at five places in the fields, covered by mechanical bird scarer, human scarer as well as where no efforts were being made to control the birds. These observations were taken during the entire period of the trial.

Observations

In the fields covered by mechanical bird scarer, the damage to *bajra* earheads ranged from 2% to 2.5%, while those which were under the care of the human scarer, 8% to 11% damage was observed. In the control field where no measures were being adopted to scare the birds the damage was 48% to 52%. It is, therefore, clear that the bird damage in the fields round about the mechanical bird scarer was $\frac{1}{4}$th only as compared with the damage caused in the fields protected by the human scarer. Besides, one mechanical bird scarer was found effectively controlling the birds over an area of 5 acres as against 1½

acres protected through human scarer. The area has been determined by working the distance in the fields round about the bird scaring source upto the place where birds fly away after settling as a result of explosion or stone throwing. Within this limit also the figures of the extent of damage observed in the various plots from time to time were taken to indicate that the crop nearer to the bird scaring source was comparatively less damaged by the birds than the crop farther from it.

Economics of control operation

(a) Mechanical bird scarer

The working cost of one mechanical bird scarer per day of 10½ working hours was about Re. 1. It could check the birds around over an area of 5 acres and help to save damage upto the extent of about 48%, as compared with the control field. Taking the average yield of *bajra* as 8 mds. per acre, the saving in grain due to mechanical bird scarer is about 3 maunds and 33 seers or in terms of value Rs. 38.00 (@Rs. 10.00 per maund) approximately. Since the working cost of the mechanical bird scarer is 20 nP. per acre, the saving can, therefore, safely be assumed Rs. 37.80 nP. per acre. An Indian made bird scarer costs Rs. 187.50 nP. and if used in *bajra* crop over an area of 5 acres, the farmer can realise the cost of the machine in one year. A mechanical bird scarer can serve the farmer for more than 5 years if maintained properly.

(b) Human scarer

The damage recorded in the field looked after by the human scarer was 10% on an average. This method could save only about 40% of bird damage as compared with the control fields and thus in terms of crop yield, 3 maunds and 8 seers were saved per acre assuming the yield of *bajra* at 8 maunds per acre. Through human scarer the saving of grain is 25 seers costing Rs. 6.25 at Rs. 10 per maund) less than the saving obtained through the mechanical bird scarer. This method is, therefore, less economical besides being limited in scope.

(c) Control

In the control field the damage on an average was 50% *i.e.* 4 maunds per acre assuming the yield of *bajra* to be 8 maunds per acre. The loss in terms of value is, therefore, Rs. 40 (@Rs. 10 per maund) per acre.

In all the three trials the birds did not show any sign of indifference towards sound produced by the mechanical bird scarer. They always flew away with the bang. Parrots were the most intelligent lot of all the birds and took short flights only to return back to the orchard or field and settle till the next bang. This was observed after a few days of the operation of the mechanical bird scarer.

Conclusions

(i) Mechanical bird scarer is more efficient than the methods employed by the human scarers in driving the birds away.

(ii) A mechanical bird scarer can effectively control birds over an area of 3 to 5 acres. It covers less area in orchards and more in the fields.

(iii) The cost per acre for controlling birds is less by mechanical bird scarer than by manual methods.

(iv) No tendency in the birds to become used to sound from the mechanical bird scarer was observed. Among the birds, the parrots were observed to fly away with the bang and again settle on the trees till the next bang after a few days of the operation of the machine.

(v) The bird damage is much reduced in the orchard if the mechanical bird scarer is supported by a couple of human scarers also.

COTTON SEED FUMIGATION WITH METHYL BROMIDE

By

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AND

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The pink bollworm (*Platyedra gossypiella* Saund.), which is one of the most destructive insects in the world, is reported to be quite serious in Indore division of Madhya Pradesh. In this division alone, cotton is grown in about 16,07,300 acres, and the infestation of this pest in cotton seed is estimated at 10%.

The insect passes the winter in the larval stage, mostly inside the stored seed. Pupation generally takes place inside the boll, often in that portion of the seed hollowed by the feeding of larvae. Taking advantage of this habit of the pest, large scale fumigation of cotton seed with methyl bromide was undertaken at Burhanpur, district Khandawa, Madhya Pradesh, during May, 1961.

Equipment used

1. Vynide covers (Gas proof) of 18′ × 16′ × 15′ size.
2. Methyl bromide (Embafume 'C') in cylinder of 63 kg. capacity, with cock key for opening the cylinder.
3. 3 lb. capacity applicator for measuring the required quantity of methyl bromide.
4. Two 'Puretha' gas masks with 'O' type black canisters with orange stripe.
5. A 2-3 feet copper tube with appropriate nuts at both the ends, one for mounting on the inlet valve of the applicator and the other for mounting on the outlet valve of the cylinder.
6. A 3-feet copper tube with appropriate nut at one end for mounting on the outlet valve of the applicator.
7. A 30-feet plastic tube for connecting the outlet copper tube with the stack.
8. Sand snakes made of hessian or other thick cloth filled with sand.

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Method adopted

Six hundred cotton seed bags, each weighing 1¼ mds., were stacked in a suitable manner in an open space and were covered with one vynide cover. The loose ends of the cover touching the ground were strectched and the sand snakes were kept on the edges of the cover all round to render it airtight. At the top of the stack few bags were kept edgewise to form a sort of dome so as to provide some free space for the easy diffusion of the gas. The applicator was fitted on a wooden stand at a distance of about 6 feet from the stack. The two copper tubings were fitted on both the inlet and outlet valve of the applicator. The other end of the copper tube, fitted on the outlet valve was connected with a 30-feet plastic tube, which was then inserted in the stack through a funnel type opening provided at the top centre of the vynide cover. Care was taken to properly tie down the funnel type opening to render it air-tight without bending the plastic tube. At this stage the operator, wearing the gas mask, tried the spindle valve of the cylinder with cock key while the check nut fitted on the cylinder outlet valve was still on. Finding that the spindle valve worked smoothly, the same was closed and the checknut was removed. The other end of the copper tube fitted on the inlet valve of the applicator was mounted on the outlet valve of the cylinder. All the connections were again checked and then the spindle valve was opened, simultaneously opening the inlet valve of the applicator. Immediately the liquid methyl bromide started flowing in the applicator. The air-valve provided at the top of the applicator was slightly opened and closed immediately to allow the air in the applicator to escape. When the required quantity of methyl bromide was admitted in the graduated applicator, the spindle valve was closed first and thereafter the inlet valve of the applicator so as to enable the remaining liquid in the copper tube to pass in the applicator. The outlet valve of the applicator was then opened slowly to release the methyl bromide in the covered stack through the plastic tube. The outlet valve was closed when all the methyl bromide had been released. After releasing the required quantity* of the gas in the stack, both the couplings on the inlet copper tube were removed and the checknut was fitted back on the cylinder. The plastic tube was removed from the stack, taking care to close the funnel opening of the vynide cover properly.

The next day, after completion of 24 hours' exposure, two operators wearing the gas mask, pulled out one side of the vynide cover by standing on the stack, with their faces opposite the direction of wind. The stack was left as such for about two hours to enable the gas to disperse. The cover was then removed completely.

It has been observed that fumigation of cotton seed on a large scale in an open space under vynide covers is very convenient and involves least risk to the operators. The cost of fumigation in this

*In this case 1¼ lb. of methyl bromide per 1,000 cubic feet of space was used.

case was approximately 12 naye paise per bag of 1¼ mds. This includes the cost of fumigant, labour for stacking the bags and other incidentals.

Points to Remember

1. Wear gas mask with proper canister while undertaking fumigation work. Canister as supplied by the manufacturer is sealed by a cap over the inlet valve at the bottom. The cap should be removed during use and replaced afterwards. It is safe to use the same canister for not more than 24 hours in all, hence it is necessary to keep a complete record of its use. Gas mask is used only as a precautionary measure and is of no help in heavy concentrations of the gas.

2. Before starting the operations, check the working of the spindle valve while the check nut is still fitted on the outlet valve of the cylinder. The spindle valve should work smoothly and no extra force should be applied. It is essential to lubricate the spindle valve for fifteen minutes before attempting to work it. Make sure that all the couplings are airtight.

3. While allowing methyl bromide in the applicator if any sudden leakage is noticed, close the spindle valve of the cylinder and the inlet valve of the applicator immediately and leave the place of operation, so as to enable all the liquid in the inlet copper tube to leak out. Similarly, while releasing the gas in the stack, if any sudden leakage is detected, leave the site immediately after closing the outlet valve of the applicator.

4. Preferably, fumigation work should be done in the open. In case this is not possible, and fumigation is done inside the godowns, a Halide leak detector lamp should invariably be used to detect the concentration of the gas in the atmosphere. Warning sign should be displayed near the fumigated stack. No one should be allowed to approach the fumigated stack without gas mask.

5. Any person accidentally exposed and showing the symptoms of fatigue, headache, dizziness, nausea, vomiting etc., should have medical attention immediately. Have the patient lie down and keep him warm. Give hot tea or coffee and the doctor may administer caffeine sodium benzoate 0.5 gm. subcutaneously or intravenously. Rinse the mouth of the patient with sodium thiosulphate, 10% solution.

Acknowledgements

We are indebted to Shri N. N. Hukku, Cotton Extension Officer, Madhya Pradesh, Indore, for providing this opportunity for undertaking large scale cotton seed fumigation for the first time in the State of Madhya Pradesh.

Thanks are also due to Shri M. A. Holkar, Plant Protection Assistant, Indore, for his assistance in this work.

FUMIGATION OF COTTON BALES

By

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Many countries allow the entry of raw cotton and cotton seed only after fumigation in order to prevent the introduction of important cotton pests like the cotton boll weevil, *Anthonomus grandis* Boh., and the pink boll worm, *Pectinophora gossypiella* (Saund.). To prevent the entry of the cotton boll weevil into India, all American and West Indies cotton is fumigated at the ports of entry and large scale fumigation of cotton bales is done at Bombay, Calcutta, Cochin and Madras seaports by employing HCN.

Experiments were carried out at the Plant Quarantine Station, Bombay, during 1957, with liquid HCN and methyl bromide to compare their efficacy and to determine the concentration/time factors. One of the objects was also to find out the extent of absorption of fumigants by cotton bales.

Procedure.—Standard cotton bales hydraulically pressed and measuring $5' \times 2\frac{1}{4}' \times 2'$ were used in the absorption experiments. Adults of *Tribolium castaneum* Hbst., and *Sitophilus oryzae* L., collected from local godowns, were used as test insects. Absorption experiments were conducted in a 50-cu. ft. fumigation chamber and the other experiments in a 250-cu. ft. fumigation chamber at atmospheric pressure and room temperature ranging from 80° to 90°F. Each experiment was duplicated and the test insects, 20 in each specimen tube, were placed in 5 separate positions in the chamber. Test insects were supplied with food during and after experiments. Suitable controls were maintained for each experiment.

Fumigant gases were drawn out for analysis by means of a sampling tube from different places in the chamber, at intervals of 1, 2, 3, 4 and 20 hours after the application of the fumigant. Mortality counts were taken, immediately and 24, 48, and 72 hours after the end of the exposure period. Absorption of the fumigant by the cotton bales was calculated on the basis of the concentration of the gas in the open spaces in the chamber. Some experiments without using cotton bales, were also conducted to determine the effect of various concentrations of fumigants on test insects. The fumigants were introduced into the fumigation chamber by means of an applicator. Since the test insects feign death, appear moribund after removal from the chamber and recover later, observations on mortality were continued for 72 hours.

HCN and methyl bromide.—Two sets of experiments were conducted with these fumigants. In one, the absorption of the fumigants by cotton bales and the mortality of the test insects were observed. In the other, experiments without cotton bales were conducted to observe

the mortality of insects with such dosages of HCN as would yield approximately the same concentrations as observed in the experiments with the cotton bales.

The results of absorption experiments are summarised in Table I. In 20 hours 93.2% and in one hour 67.5% of HCN gas introduced was absorbed by the cotton bales, when the dosage applied was 8 oz./1,000 cu. ft. The absorption, however, decreased with increased dosages at the end of 20 hours. The rate of absorption is gradual and only 4-8% increase is registered in four hours after the introduction of the gas into the chamber, the rate being slower at higher dosages.

The results of absorption experiments are summarised in Table 1. slower than that of HCN. In the first hour, the absorption is only 2.5% as compared to 67.8% of HCN and even after an exposure of 20 hours the absorption was only 44.6% as compared to 88.1% in the case of HCN, when the dosage used was 12 oz./1,000 cu. ft.

Observations at the end of 20 hours' exposure showed complete mortality of *T. castaneum* at all dosages of HCN used, but 100% kill of *S. oryzae* occurred only at the dosage of 24 oz./1,000 cu. ft. Complete mortality of both the species occurred at all the dosages of methyl bromide used.

Blank experiments with HCN.—After obtaining a relationship between the volume of gas absorbed by cotton and the concentration of gas present in the chamber and its effect on insects, it was necessary to determine the actual concentration required for 100% mortality of the insects, specially when it was not known whether any of the absorbed gas had been desorbed and to what extent it had influenced the mortality. Therefore, some experiments without using cotton bales, were also conducted with HCN. The same procedure, as described before, was followed.

The results are given in Table 2. A dosage of 0.65 oz./1,000 cu. ft. (415 p.p.m.) for 20 hours resulted in 100% mortality of *T. castaneum*, whereas 66% mortality was obtained in the case of *S. oryzae*, 72 hours after the exposure period. Similarly, 1.5 oz./1,000 cu. ft. (1,200 p.p.m.), also gave 100% kill of *T. castaneum* but only 76.5% kill of *S. oryzae* was obtained 72 hours after the exposure period. A dosage of 5.3 oz./1,000 cu. ft. (4,500 p.p.m.) for 6 hours gave only 88% kill of *S. oryazae* 72 hours after the exposure period. However, with an exposure period of 10 hours 100% mortality was obtained. An exposure of 20 hours with 2.65 oz./1,000 cu. ft. (2,200 p.p.m.) gave 100% kill of *S. oryzae*. *T. castaneum* was killed at all concentrations and exposure periods. This indicates that to obtain 100% mortality of *S. oryzae* a concentration of 5.7 oz./1,000 cu. ft. (4,500 p.p.m.) should be maintained for 10 hours or a concentration of 2.65 oz./1,000 cu. ft. (2,200 p.p.m.) for about 20 hours. The results also indicate that *T. castaneum* is more susceptible to HCN and methyl bromide than *S. oryzae*.

Acknowledgements

The assistance of Sarvashree S. B. Manshani, A. G. Kubair and L. M. Satyapal in conducting these experiments is gratefully acknowledged.

TABLE 1

Absorption of fumigants by cotton bales and the mortality of insects

Fumigant	Dosage (oz. 1,000 cu. ft.).	Concentration of fumigant in the chamber; oz./1,000 cu. ft., after hours; (in p.p.m.)			% fumigant absorption by cotton bales, calculated after hours			% mortality, exposure 20 hours		
								S. oryzae		*T. castaneum*
		1	4	20	1	4	20	Immediately after exposure	7 hours after exposure	Immediately after exposure
1	2	3	4	5	6	7	8	9	10	11
HCN . . .	8	2.6	1.2	0.6	67.5	84.6	93.2	59.5	67.5	100
	12	3.9	3.3	1.5	67.8	75.6	88.1	70.5	75.5	100
	16	4.5	3.7	1.9	70.6	76.7	88.4	83.0	87.0	100
	24	8.7	6.9	3.6	64.0	71.5	85.1	100	..	100
Methyl bromide . .	12	11.7	7.6	6.7	2.5	35.9	44.6	100	..	100
	16	15.7	10.5	9.5	1.9	34.4	40.9	100	..	100
	24	23.5	16.6	13.1	2.1	31.5	42.5	100	..	100
	32	31.9	21.9	18.1	0.8	31.6	43.6	100	..	100

TABLE 2

Effect of HCN on test insects in the absence of cotton bales

Dosage (Oz./1,000 cu. ft.) and Concentration (p.p. m.)	Exposure period in hours	% Mortality		
		S. oryzae		*T. castaneum*
		Immediately after exposure	72 hours after exposure	Immediately after exposure
1	2	3	4	5
0.65 (415) . . .	20	57.0	66.0	100
1.50(1200) . . .	20	71.5	76.5	100
2.65 (2200) . .	20	100.0	..	100
5.3 (4500) . . .	10	100.0	..	100
5.3 (4500) . . .	6	84.0	88.0	100

OUTBREAK OF GRAM BLIGHT IN PUNJAB IN 1958-59

By

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The blight disease of gram, caused by the fungus *Phyllosticta rabiei* (Pass.) Trot., and locally known as *tawi, kawa, bulla, chamak* and *chandani* has few parallels in the field of plant pathology in so far as its destructiveness is concerned.

During the *rabi* season of 1958-59, owing to the weather conditions having become extremely favourable to the development and spread of the disease, it has been observed that the gram crop at many places in the districts of Gurdaspur, Amritsar, Jullundur, Hoshiarpur, Ludhiana and Ambala, has been severely damaged and no yield is expected from the devastated fields. As such, the farmers may not even harvest these fields. Such fields, thus will serve as store-houses of highly infectious material to bring about a similar devastation of the crop during the *rabi* season of 1959-60, if the weather conditions again become favourable. To minimise the chances of such a dreadful recurrence, it is imperative that all-out and concerted efforts should be made at the time of the harvest of the gram crop and during the monsoon season to destroy the diseased gram plant debris by the following methods:

1. The diseased crop, whether any yield is expected from it or not, must be harvested very close to the ground, so that no stumps are left behind. Where the soil of the fields may be light, the diseased crop should preferably be uprooted with hand. The diseased crop may be collected in a heap and destroyed by burning. Alternatively, it may be converted into compost, in which case the fungus is killed and the manure resulting therefrom is rendered harmless.

2. The partially diseased crop, of course, will be harvested and threshed by the farmers, but a good deal of diseased refuse will be left behind on the threshing floor. Immediately after threshing the crop, the threshing floor must be swept clean and the refuse, so collected, should be either burnt or buried deep underground.

3. Stacks of diseased *bhusa,* if erected in the fields, will serve as a source of infection for the succeeding gram crop. After the stacks are removed, a good deal of diseased *bhusa* remains behind at the sites of their erection. This diseased *bhusa* is blown about by wind during the crop season, and becomes a potent cause of primary infection in the crop. Either the *bhusa* stacks must not be erected in the fields or, if they are erected, the diseased *bhusa,* left behind after the stacks are removed, must be burnt or buried underground immediately.

4. Fields, that have borne a diseased crop and from which the diseased debris has been destroyed by the methods detailed above, should be worked up with furrow-turning ploughs during the monsoon season to bury and destroy the disease remnants.

5. The successive cultivation of gram crop in the same field is one of the main causes that lead to the initial out-break of the disease and its subsequent spread. This faulty practice, therefore, must be avoided and the gram crop should be rotated with wheat or barley.

6. Where feasible, gram and wheat or barley may be sown mixed in alternate rows. This practice is an insurance against total loss to the farmers, if the disease breaks out in an epidemic form, because at least the cereal will escape destruction.

7. Since the above cultural methods cannot be carried out to the level of perfection, the blight disease is liable to break out, if the weather conditions become extremely favourable to its development and spread, *viz.*, frequent rains and strong winds during the growing period of the crop. Resistant varieties, therefore, constitute the most dependable method of controlling the disease. The blight disease had been tackled successfully about two decades ago in the pre-partition Punjab by selecting and evolving through hybridization blight-resistant and high-yielding gram varieties. Those varieties continued to resist this destructive disease upto the year 1951-52, when, all of a sudden, they began to show moderate to severe infection. The work of testing new gram varieties and crosses was, therefore, taken up during the gram season of 1952-53. Out of more than 250 varieties and crosses tested since 1952-53, 6 crosses produced by hybridizing the blight-resistant variety F. 8 with the local gram varieties, though not totally resistant under conditions of heavy artificial inoculation, catch only light infection. Out of them, Nos. 235 and 400 seem to be very promising not only in respect of resistance to the disease, but also yield and quality. The seed of these new varieties will be multiplied and distributed among farmers of the affected localities to minimise the losses due to this disease.

EFFECT OF METHYL BROMIDE FUMIGATION AND HOT WATER TREATMENT ON *SACCHARUM SPONTANEUM*

By

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The normal plant quarantine treatments for sugarcane, *Saccharum* spp. involve fumigation with methyl bromide at the rate of 1 lb. per 1,000 cu. ft. for 1½ hours or 1½ lb. per 1,000 cu. ft. for 1 hour at atmospheric pressure and hot water treatment for 20 minutes at 52°C. Recently, Rao and Ethirajan (1956)* reported serious damage to the sugarcane plants raised from *Saccharum spontaneum* L. setts treated with methyl bromide. Their observations, which were based on a single trial using 25 cc. of methyl bromide per 60 cu. ft. (or 1.91 lb. per 1,000 cu. ft.) for 1½ hours, showed that the initial germination, sett root formation and normal growth of the sprouts were adversely affected by the treatment. Detailed trials were, therefore, undertaken in 1957, at the Plant Quarantine & Fumigation Station, Bombay, to study the effect of methyl bromide fumigation and hot water treatment on the germination and growth of *S. spontaneum* and also to arrive at an optimum dosage schedule for the fumigation of sugarcane setts.

Procedure

Setts of *S. spontaneum* for the trials were obtained from the Agronomist, Agricultural Research Station, Padegaon, Poona District, Bombay State. The canes were carefully stripped of any remnant of leaf sheath and divided into setts of equal size, each sett containing about 3 buds or 'eyes'. The cut ends of the setts were waxed in order to create conditions similar to those of canes usually imported for planting purposes.

The following series of experiments, comprising 25 treatments in all, were conducted :—

A — Fumigation alone

B — Hot water treatment alone

C — Fumigation followed by hot water treatment

D — Hot water treatment followed by fumigation

All fumigations were done by using dosages of 1, 1½ and 2 lb. of methyl bromide per 1,000 cu. ft. with exposure periods of 1, 1½ and 2 hours. Sugarcane setts were subjected to each of these dosages for all

*Rao, J. T. and Ethirajan, A.S. (1956). On methyl bromide as a plant fumigant. *Curr. Sci.* **25(5)** : 160-161.

three exposure periods excepting the dosage of 1½ lb. for 2 hours. In experiments under series 'C', the sugarcane setts after fumigation, as under series A, were subjected to hot water treatment for 20 minutes at 52°C. In series 'D', the sugarcane setts treated with hot water for 20 minutes at 52°C were subjected to fumigation as under series 'A'. Ten cuttings were used for each treatment. All fumigation were carried out in a 250 cu. ft. fumigation chamber at atmospheric pressure and at room temperatures ranging between 80 and 90°F. Hot water treatments were given in a 18 cu. ft. hot water tank. Control was maintained for each treatment. The sugarcane setts which received hot water treatment before they were subjected to fumigation were kept in the open till no moisture was found on them. After the treatments, the setts were planted in large baskets with adequately manured soil. Observations on the germination of the setts and growth of the sprouts were taken at regular intervals. Final readings on the growth of *S. spontaneum* were recorded 43 days after germination.

Samples of the treated sugarcane setts were analysed for determining the residual bromine.

Observations and Results

Germination of both treated and untreated setts occurred in about 8 days after planting. Germination was rather inconsistent in the various treatments and ranged from 21.2 to 64.3%. The maximum germination of 64.3% was observed in setts fumigated with methyl bromide at the rate of 2 lb. per 1,000 cu. ft. for 1 hour followed by hot water treatment. Maximum tillering was observed in the case of setts fumigated at 2 lb. per 1,000 cu. ft. for 1½ hours followed by hot water treatment. Fumigation at the rate of 1 lb. per 1,000 cu. ft. for 1½ hours preceded by hot water treatment resulted in the best alround growth, such as tillering and plant and root development, although germination in this case was comparatively low.

The plants were normal in all treatments and no dying of the sprouts or blackening of the roots occurred as was observed by the previous authors.

The chemical analysis of the fumigated setts for the presence of bromine indicated certain interesting facts. The absorption of methyl bromide was greater in sugarcane setts which were first given a hot water treatment and then fumigated. Least absorption was found in setts which were first fumigated and later subjected to hot water treatment. Between these two ranks in the treatment of fumigation alone, it was also observed that absorption of methyl bromide increased with increased dosages and exposures. The residual bromine in the fumigated setts was from 15 to 85 p.p.m. No bromine was present in the setts which were used for control and for hot water treatment.

The lower concentrations of bromine in the sugarcane setts which were first fumigated and then subjected to hot water treatment may be due to the heating during hot water treatment, when some of the methyl bromide absorbed might have escaped from the setts. The higher concentration in the setts first subjected to hot water treatment and later to fumigation may be due to the greater absorption of methyl bromide in the presence of higher moisture and increased porosity of the cells of the setts due to heating. The concentrations of bromine in no case reached beyond 85 p.p.m.

Conclusions

The experiments indicated that methyl bromide even at a dosage schedule of 2 lb. per 1,000 cu. ft. for 2 hours will have no adverse effect either on the germination of *S. spontaneum* setts or the growth of sprouts from such setts. In general, better tillering and stand were observed in sprouts from the setts which were given the combined fumigation and hot water treatments. The fumigation did not also leave any harmful concentrations of residual bromine in the treated setts so as to affect the germination, root formation, tillering or the growth.

Acknowledgements

Grateful acknowledgements are made to Dr. K. B. Lal, Plant Protection Adviser to the Government of India, for providing facilities for this work and to the Agronomist, Incharge, Agricultural Research Station, Padegaon, Bombay State, for supplying the sugarcane setts required for the experiments.

SEED-POTATO PRODUCTION AND CERTIFICATION IN SCOTLAND

By

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INTRODUCTION

A scheme for the production of disease-free seed of the variety *phulwa,* which, along with the variety Darjeeling Red Round, constitutes about 80 per cent crop in the plains (Deshmukh, 1952), was started in some parts of Uttar Pradesh during 1944-45. Since then, some other States have undertaken similar work. In Himachal Pradesh, which is one of the largest seed-potato producing States in India, a full-fledged scheme is in operation since 1949 (Pushkarnath, 1952). The importance of disease-free seed-potato has since increasingly been realised and efforts are being made to improve the stocks in the country. Some details of the recent methods of seed-potato production and certification in Scotland, which the writer had an opportunity to study during his deputation in the United Kingdom in 1957, as a Colombo Plan Fellow, are reported in this paper.

Historical

Scotland is one of the foremost seed-potato producing countries in the world, the yields of good, healthy seed being often about five tons per acre. The value of Scottish seed was recognised as far back as 1778, when it was realised that the crops raised from it were comparatively free from 'curl', as against those from seed from the south of Britain. Since then, there has been a continuous flow of seed-potato from Scotland to England and other countries, the present exports being of the order of about 3,00,000 tons every year.

The scheme for the certification of growing crops of potato was first introduced by the then Board of Agriculture in 1918, especially to ensure varietal purity and to keep the crops free from rogues which might be susceptible to wart disease. In 1922, the Departement of Agriculture first issued 'Stock Seed' certificates in respect of crops which achieved a reasonable degree of freedom from undesirable plants and diseases. However, the crops could not be freed from virus diseases, especially virus X, in spite of thorough roguing. This led to an attempt to raise stocks from selected plants in 1925. But it was not until 1945, that a concerted effort was made to produce disease-free stocks. In that year, Sir J. D. Roberts, a leading seed-potato grower, started to build up such stocks. The Department of Agriculture and other

growers followed in 1946. Four years later, the Department of Agriculture introduced a scheme for the inspection and certification of virus-tested stocks and about 31 acres of virus-tested stocks were registered. Another 400 acres, derived from such stocks, were certified as 'Special' or 'Starred Stock Seed' crops. In 1953, however, a special grade, known as 'Foundation Seed', was instituted for seed derived from virus-tested stocks.

GRADES AND STANDARDS OF CERTIFICATES

The certification of seed-potatoes in Scotland has evolved over a period of about 35 years. In the beginning, there was a tendency to prescribe rather arbitrary standards and requirements for the various certificates. But now, they are based, wherever possible, upon scientific knowledge and practical experience.

Till 1955, the following six grades of certificates were granted in the descending order: 'Virus-tested Stock' (V. T. S.), 'Foundation Stock' (F.S.), 'Stock Seed' (S.S.), 'A', 'H' and 'Grade B Report'. Because of general improvement in the stocks, the issue of the last certificate was dropped in 1956, and the 'H' certificate may be eliminated soon. (Already 'H' crops were not eligible as a source of certified seed in 1958).

The standards and requirements prescribed for the various certificates in 1957, are given in Appendix 'A'. In that year, an additional certificate was provided for washed seed-potatoes, especially for seed from crops which attained requisite standards except for the infestation of root eelworm. The washing was required to be carried out in a manner prescribed by the Department of Agriculture and ensured freedom of the tubers from soil and root eelworm cysts, if any, adhering to them.

For the first three grades, the tubers are inspected and sealed by the inspectors of the Department of Agriculture before they are allowed to be removed from the farm. For all grades, the growers are required to maintain a proper record of their sales, stating the names and addresses of the buyers. They are also required to furnish their names and addresses to the buyers, as also the respective certificate numbers, name of variety, seed size, etc. (All seed is usually of $2\frac{1}{4}'' \times 1\frac{1}{4}''$ size). All records are subject to inspection by the Department of Agriculture.

Organisation

Seed-potato certification in Scotland involves two main operations: (i) roguing of diseased and undesirable plants, and (ii) inspection of the growing crops prior to issue of certificates. The first is the grower's responsibility. The actual extent of roguing, permissible prior to inspection for various certificates, is indicated in Appendix A, column 11. It is considered to be a technical job and is not always attempted by the grower himself. There are 'roguers', many of whom are trained at the Agricultural Colleges and possess certificates awarded on the basis of a test. They are engaged by the seed-potato growers on lucrative emoluments.

The inspection of growing crops is done by the Department of Agriculture through its permanent Inspectorate, as also a large number of temporary inspectors appointed just for the period of inspection. In 1956, 154 temporary inspectors were engaged for the work. The temporary inspectors are usually students, teachers, or from the farming communities, and, whenever possible, they are re-employed year after year. Those who are new are trained at the Department's 'Scientific Services' at East Craigs, and the required number is selected on the basis of a practical test. Subsequently, all inspectors, permanent or temporary, who are to undertake inspection of growing crops and seed-potatoes, undergo a further intensive training at East Craigs. Supervisers and senior and junior inspectors are then appointed with due regard to the merit and experience of the individuals in potato inspection work.

During the growing-crop inspections, a senior and a junior inspector work together. A standard method, represented diagramatically in Fig. 1, is usually followed. Crops for 'V.T.S.,' 'F.S.', and 'S.S.' certificates are inspected at least twice during the season, while only one inspection is undertaken in the case of the lower grades. A re-inspection is, however, permissible in the latter case if the grower undertakes necessary roguing, etc., to bring the crop to the requisite standard and pays extra fees to the Department of Agriculture. Actual counts for purity and virus disease incidence are made by the two inspectors separately, and an average of these is taken for purposes of grading. If possible, all plants are examined for 'V.T.S.' certificates; the same is true for 'F.S.' and 'S.S.' certificates if the crop is less than an acre, otherwise a minimum of one acre is examined at each inspection. For the lower grades, random counts are made throughout the field. In the case of crops for 'V.T.S.' and 'F.S.' certificates, plants suspected to be infected with viruses are tested serologically, on the spot. All border-line crops, *i.e.*, those which approach the maximum limit of a lower grade, or the minimum of a higher grade, are normally submitted to the district superviser for a decision. The observations and recommendations of the inspectors are forwarded to the Department of Agriculture, which then issues the appropriate certificate after necessary scrutiny.

The grower himself, or his representative, is encouraged to accompany the inspectors during the inspection. This is intended to train the grower in the various objects and standards of the scheme. The grower is also permitted to appeal to the district supervisor, if he is not satisfied with the judgment of the inspector.

A 'Register of Certified Potato Crops' is published by the Department soon after the inspections are over, usually by the middle of October, for the benefit of prospective buyers of seed for the next season. The 'Register' also indicates the susceptibility or inmunity of the varieties to wart disease.

Every year, in winter, the working of the schemes is discussed at various conferences involving representatives of growers, merchants and the Scientific Services and administrative officers of the Department of Agriculture. A description of the approved schemes is sent, the following spring, to all seed-potato growers in the country.

Production of Virus-tested seed

As production of 'Virus-tested seed' in Scotland is of special interest, a separate treatment of the subject would not be out of place. While the object of this scheme is to produce seed-potatoes free from known viruses, it is the strains of potato virus X, causing mild mosaics, which are specially sought to be eliminated.

Production of 'Virus-tested seed' is undertaken both by private growers as well as by the Department of Agriculture. In 1956, there were four such private growers. There is a close collaboration between the growers and the Department of Agriculture, which ensures application of sound techniques throughout the process. To start with, facilities available with intending growers are inspected. Till recently, the growers were required to have ability and facilities to perform either biological or serological testing of plants. Now, however, the Department of Agriculture has decided to encourage small growers, too, and slide-agglutination tests have been permitted. The antiserum will be provided by the Department of Agriculture at a nominal cost.

The crops are required to be grown and tested according to a fixed procedure. The Department of Agriculture also undertakes regular inspections and tests, even prior to the actual year of certification. The crops become eligible for certification in the third year, when at least two growing-crop inspections are undertaken and the plants tested as necessary. Some tubers are also tested at East Craigs for trueness to type. No 'V.T.S.' certificate is granted after the fifth year, or before that, if the stock has changed hands.

The seed from 'V.T.S.' is sold, subject to certain conditions, in lots of not less than 10 cwts., and for propagation in Scotland only.

ACHIEVEMENTS

Of the diseases of potato in Scotland, those caused by fungi and Actinomycetes are laregly taken care of, especially in the case of first three grades of seed potatoes, at the time of tuber inspection, prior to sealing of the stocks. The 'Wart Disease of Potatoes Order' and check inspections by the Department of Agriculture, under the 'Sale of Diseased Plants Control Order', too, have tended to reduce their incidence in the country. A few growers undertake disinfection, as a routine practice, to get rid of dry rot (*Fusarium caeruleum* (Lib.) Sacc.), skin spot (*Oospora pustulans* Owen & Wakep.) and similar other surface-borne diseases. At a commercial washing plant, the seed-potatoes are passed over carrier-belts, running at a slow speed, and are washed

by coarse jets of water, followed by finer jets, at a pressure of about 70 lb. per square inch, with a view to freeing the tubers from adhering soil and, with it, the root eelworm cysts, if any.

The important virus diseases, such as those caused by 'Potato Leaf Roll Virus' and 'Potato virus Y' as also the strains of 'Potato virus X' which cause severe symptoms, are usually controlled by the growers through routine roguing operations.

The seed-potato certification schemes have, in addition, helped greatly to raise the general health and purity of the stocks in the country. Most of the stocks of the major variety 'Majestic', are free from potato virus 'A', a wide spread virus, and many are now raised from virus-tested seed. The acreages of potato crops, entered and certified for the various grades in 1956, are given in Table 1. In Appendix B are given the acreages of crops, of a few popular varieties, certified for the various grades in the same year.

TABLE I

Acreage of seed-potato crops certified for various grades in 1956

Total area inspected.	Area certified					Area uncertified.
	V.T.S.	F.S.	S.S.	A.	H.	
83,289.75	68.25	1,850.25	4,746.75	57,938.5	13,533.25	5,152.75

On the other hand, the Department of Agriculture has taken special measures to prevent the spread of 'Veinal Necrosis Virus' (VN), which was recently detected in a variety Craigs Royal. During the winter of 1956, about half a ton of seed of this variety was tuber-indexed and tested biologically, and raising of VN-free stock is in progress.

Acknowledgements

The writer is grateful to the Government of India and the United Kingdom for the nomination for, and the award of, a fellowship under the Colombo Plan. Thanks are also due to the Department of Agriculture for Scotland for the necessary facilities to study the detailed working of the seed-potato certification schemes, and for permission to reproduce some of their data on acreages of certified crops.

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APPENDIX A

Summary of Standards prescribed for Seed Potato Certification in Scotland in 1957

Certificate	Origin of seed	Varietal purity %	Maximum tolerance allowed							Extent of roguing permssible prior to first inspection
			Rogues	Undesirable variations	Bolters	Semi-bolters	Leaf roll	Severe mosaic	Mild mosaic	
1	2	3	4	5	6	7	8	9	10	11
'Foundation Stock Seed'	V.T.S. or 'F.S' of 1956	99·95	0·05%	0·05%	0·05%	*0·5% @0·05%	*4 plants @ 2 per acre	*2 plants @ 0 per acre	10 plants per acre	20 plants per acre
'Stock Seed'	V. T. S. F. S. or S.S. of 1956	99·95	*0·1% @0·05%	*0·1% @0·05%	*0·1% @0·05%	*2·0% @0·1%	4 plants per acre	4 plants per acre	0·25%	1%
'A'	Seed certified in 1956	99·5	0·5%	0·25%	0·25%	Not considered	0·5%	0·5%	2·0%	2%

'H'	Seed certified in 1956	99.5	0.5%	0.25%	0.25%	Not considered	2.0%	2.0%	Not considered	2%

1. For 'F.S.' and 'S.S.' certification, the crops should be at least 20 yards away from any crop not attaining certification standard.

2. (a) No potato crop must have been grown on the land during the preceding five years, *viz.*, 1952—56. However, for 'A' and 'H' crops may be grown after a shorter interval provided a presowing soil test for potato root eelworm proves negative.

(b) Absolute freedom from potato root eelworm infestation for any certificate; precropping soil test by the Department of Agriculture also necessary for 'F.S.' and 'S.S.'

3. Not more than 3% of black-leg infection for any certificate.

4. No wart disease should have ever been reported from the land on which the crop is grown.

5. Seed of different grades must be stored separately; that for sale as 'F.S.' or 'S.S.' must be inspected and sealed by the Department of Agriculture.

'V.T.S.': Virus Tested Seed : 'F.S.'. Foundation Seed; 'S.S.': Stock Seed; *First Inspection @ Second or Final Inspection.

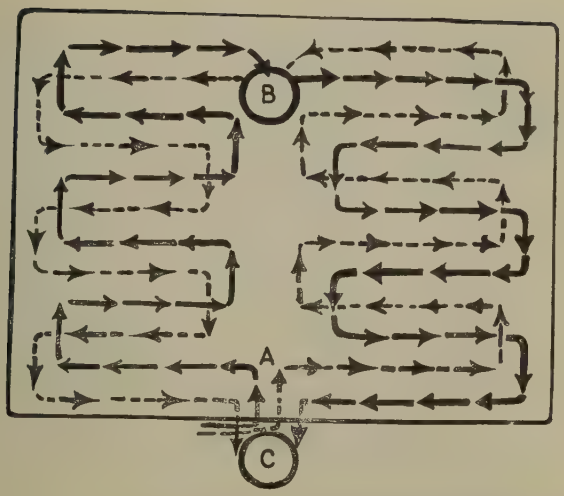
APPENDIX B

Acreage of some popular varieties certified for various grades in 1956

Variety	V.T.S.	F.S.	Area certified (acres) S.S.	A	H	Total
1. Majestic (I)	33	1,087	1,031½	17,472¾	5,950¼	25,574½
2. Kerr's Pink (I)	6¾	384½	284¾	4,102	1,155	5,933
3. Arran Pilot (I)	5½	109¾	83½	3,946¼	2,046½	6,191½
4. Epicure (N.I.)	..	..	256¼	2,209¼	52½	2,518
5. Up-to-date (N.I.)	3½	41½	712½	1,210½	39½	1,467¼
6. Dr. McIntosh (I)	½	9	39	914½	362¾	1,325¾
7. Great Scot (I)	1½	20¾	11	945¼	89½	1,068
8. Doon Star (I)	..	..	..	301¾	106½	408¼
9. Dunbar Standard (I)	1	16½	20¼	213¼	30	281
10. Bintje (N.I.)	..	..	2½	27½	..	30

I: Immune to wart disease. N. I. : Not immune to wart disease.

FIG. I



Diagrammatic representation of method of Inspection of seed potato crops for official certification in Scotland.

A—A senior and a junior inspector enter the field and start the inspection in opposite directions.

B—They meet and compare their data.

C—They meet and collate their data for purposes of grading the crop.

Fig. 2. A 2-acre field of Department of Agriculture for Scotland at Lanarkshire (1100 ft. a. s.l.) where Virus-tested seed production is in progress. (Note distance between plants 1¼′, between drills 2½′, between plots 6′.

Fig. 3. Roots of a suspected potato plant being examined for the attack of potato eelworm.

Fig. 4. Inspection of a seed potato crop in progress. In the foreground, a Supervisor looks on as a new Junior Inspector proceeds. In the background, the grower accompanies the Inspector.

Fig. 5. An agglutination test for potato viruses X and Y is made on the spot in connection with certification of a seed potato crop as 'Foundation Stock'.

Fig. 6 The Supervisor checks on the results of the Inspectors with his own observations, as a part of training to the Inspectors.

Fig. 7. Sampling for virus-testing. Leaflets are not touched by hand—they are just pinched between the folds of a cellophane bag.

Fig. 8. A collection of potato varieties at Scientific Services, Department of Agriculture for Scotland, Edinburgh, where Inspectors are trained in the identification of varieties, bolters, wildings, virus diseases, etc.

SULPHUR DUSTING AGAINST WHEAT RUST

By

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Dusting with sulphur has been recommended as one of the measures for the control of wheat rust. This measure, though effective, has not, however, been widely practiced possibly because of the following reasons:

1. High cost of treatment.
2. Wide-spread nature of the attack of wheat rust and impracticability of treating the affected area in a limited time.
3. Non-availability of sulphur dust in adequate quantities.
4. Sulphur dust causes irritation to the eyes.
5. Non-availability of suitable types of dusters.

The present paper is written with a view to giving some information on the first and the last two points. An idea of the cost of treatment with sulphur dust can be had from the large-scale dusting carried out by the Directorate in the Central Mechanised Farm, Nandpur, Jammu, during March, 1956. In all, 553 acres were dusted from 9th March to 18th March, 1956 and the quantity of sulphur dust consumed over this area was about 1 ton 16 cwt. The details of the cost of treatment are given in the annexed statement.

The wheat crop was attacked mostly by yellow rust and brown rust was only present in patches. The wheat varieties grown on the farm were C 591 and NP 718 and the intensity of attack, though moderate, was almost the same in both the varieties. The crop had reached a height of about 4 feet and was in earing stage when dusting was carried out. Power dusters were used to treat the crop from the border of the fields since they could not be carried inside without damage to the crop. A duster could effectively cover the crop upto 30 feet from the border. The interior area was dusted by hand dusters.

The cost of dusting sulphur works out to about Rs. 2.00 at the application rate of 7 lb. of dust per acre. Even at this dosage, which may appear to be less for an acre, the samples of leaves collected at random from treated area and cultured showed no germination of spores. This may mean that 7 lb. of dust are quite sufficient to treat an acre but at double this rate, which is rather more conventional, the cost may raise to Rs. 4.00 per acre, which is still within the limit as compared to the cost of other plant protection measures. If minimum three dustings are required to check rust damage during the growth of the plant, the total cost works out to Rs. 12.00 only, even at the higher dosage.

Data of yield from treated and untreated crops were collected at the time of harvest. There has not been marked increase in yield in the treated crop resulting as saving from rust damage in comparison to untreated crop. This may be due to the late dusting of the wheat crop when it was in dough stage and whatever damage was caused by the rust was in earlier stages. Therefore, the check of rust by sulphur dusting in late stage did not affect the overall yield materially.

While dusting sulphur on large scale through hand and power dusters, several difficulties were encountered in the field. The dust on entering into the eyes causes irritation, tear shedding and makes the operator leave the job of dusting. It may also cause inflammation in the eyes as experienced on the very first day of the operation. The labourers engaged for dusting with hand dusters did not continue the job after sometime. At the end of the day, some of the labourers became sick and the next day only eight turned up in place of twenty. It was observed that sulphur powder flies about in the air while filling it in the hopper of the dusters or while dusting in the field and tends to stick to the hands, clothes and also get into the eyes. Soiled hands or clothes also convey the dust into the eyes, if involuntarily used for wiping away the tears.

It is, therefore, suggested that goggles covered from all the sides should be invariably put on while handling sulphur dust and instruction given to the operators that the clothes should be changed after the operation and thoroughly washed before using again.

All types of dusters, whether manually or power operated, are not good for sulphur dusting. Sulphur dust being very fine (300 mesh) tends to stick and cake in the hopper and block the passage through which the delivery pipe is fed. In the case of an unsuitable duster the hopper has got to be tapped constantly to allow free flow of dust. In the dusting operation at Nandpur a variety of makes and types of manually and power-operated dusters were used. It was noticed that among the crank dusters the Australian make Rega duster was the best, which never clogged. Of the Indian make dusters, Orient (slinging type) was the best. The dusters which often gave trouble were the gravity feed type like Hatsuta (Japanese) or side feed type such as Shanene, Aerodust, Bharat and Premier. Out of these, Bharat is considered unsuitable for sulphur dusting. The agitator in the hopper is most important for the free flow of dust. In case of sulphur dust the dusters with brush type of agitator (as in Orient) and cutting disc type (as in Rega) are considered most suitable. The bent arm type or spinning agitators are not very effective and, therefore, dusters carrying these types of agitators fail in sulphur dusting.

In the case of the power dusters also the type of agitation and the agitator is important for its suitability as a sulphur duster. The air agitator as in Tornado Jet Junior or spiral or multi-blade agitator as in Root or Matado are satisfactory but the spinning type agitator as

in Villiers, especially in gravity feed power dusters, is not desirable. It is considered that the power dusters mounted on the light streatcher type of frames such as Matador or Baby Agricola would be quite suitable for dusting wheat crop since these have the advantage of being carried inside the field.

While dusting sulphur with power dusters, care should be taken that it is not spilled on the petrol tank or engine while filling the hopper. Sulphur catches fire very soon on coming in contact with hot surface and its presence on either of the above two parts which get hot after the engine has run for sometime may burn the duster.

For a specialised dusting job as in the case of sulphur dusting, selection of the correct type of duster is very important, otherwise there is no end to troubles with the wrong type of dusters in the field.

Statement showing progress of work and cost of Control Operation

Date	Locality	Area treated in acres	Total quantity of fungicide consumed	Machines used		No. of men engaged		Total Hrs. of actual working	
				Power operated	Hand operated	Power duster	Hand duster	Power duster	Hand duster
1	2	3	4	5	6	7	8	9	10
9-3-56	Nandpur (Narayanpur)	154	1 ton, 15 cwt. 107 lbs.	1	20	4	20	4.5	120
10-3-56	Ditto.	45	..	1	8	4	8	3	32
10-3-56	Rangpur (Trewa) .	56	..	1	8	4	8	3	40
11-3-56	Rangpur (Ajpur) .	98.25	..	1	16	4	16	3	80
12-3-56	Sai (Chauni) . .	122.5	..	2	10	6	10	8	60
18-3-56	Ditto. .	78	..	1	8	4	8	6	48

Cost of treatment

1. Sulphur dust . . Rs. 860-5-0 @ Rs. 23-8-0 per 110 lbs.
2. Labour charges . . Rs. 111-4-0 @ Rs. 1-4-0 per day for 89 unskilled labourers.
   Rs. 17-8-0 @ Rs. 2-8-0 per day for 7 skilled labourers.
3. P.O.L. . . . Rs. 25-11-0 @ Rs. 2-14-0 per gallon petrol (4½ gls.),
   Rs. 5-8-0 per gallon mobiloil (2 gls.) and Rs. 0-6-0 per lb. grease (2 lbs.)
4. Cotton waste. . . Rs. 1-14-0 @ Rs. 0-3-0 per lb. (10 lbs.)

TOTAL COST . Rs. 1,016-10-0

COST PER ACRE . Rs.1-13-5 or approximately Rs. 2-0-0.

MORTALITY OF DESERT LOCUST HOPPERS DUE TO HIGH VELOCITY WIND IN SAUDI ARABIA

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Light, temperature, humidity and wind greatly influence the activity of the desert locust (*Schistocerca gregaria* Forsk). Hussain (1937) and Kennedy (1939) have studied the effects of light on the activity of *Schistocerca gregaria* Forsk and have described both photokinetic and phototactic behaviour. Research workers also considered moisture as a factor affecting locust movements, Bodenheimer (1944), Kennedy (1939, 1945). The influence of temperature on the desert locust too has been studied by various authors, Hussain, (1937) and Kennedy (1945, 1951). The reactions of the desert locust to relative humidity have been studied by Aziz (1957).

It is apparent from the above that physical factors greatly influence the behaviour of the desert locust (*Schistocerca gregaria* Forsk). Some field observations recorded during control operations against the desert locust in Saudi Arabia are given below. These observations were made by the author in 1959 when they were in Saudi Arabia as members of an Indian Anti-locust Mission which was led by the senior author.

HIGH VELOCITY WIND AND EGG MORTALITY

In Hassa province of Saudi Arabia, rainfall is greater in spring than in winter. There is no rain in summer. During rainy season, the wind storms are of frequent occurence. These high velocity winds are responsible for shifting of sand from one place to another. In Aindhar (25°24′ N 49°24′E) in the month of March, it was found that the wind storm was responsible for the exposure of eggpods of desert locust to greater extent than it has ever been found in the desert areas of India. The eggpods were seen dried up like mushrooms. Emergence of hoppers was very poor in a few areas due to this phenomenon and wind storm thus was responsible for the natural control in the egg stage.

HIGH VELOCITY WIND AND HOPPER MORTALITY

In Aindhar (25° 24′ N 49° 42′ E), during the second week of April, 1959, there was wind storm, which swept over the area for 72 hours. Before the onset of wind storm, one of the authors (S.P.A.) had been undertaking control operations against hoppers of desert locust. An area of 3×1 square miles, heavely infested with II and III instar hoppers, was left over to be controlled next morning. Due to wind storm no control operations were possible for 3 days. After the wind storm stopped, this area and adjoining areas were visited by the authors.

Very few live hoppers could be seen. During survey it was found that a good number of hoppers had died. The mortality of these hoppers could be attributed to the following factors:—

(i) *Exhaustion.*—Due to strong currents of wind blowing continuously the hoppers took shelter beneath the bushes. The hoppers which were blown up from the bushes could not get hold of the bushes and their continuous efforts to catch hold of some shelter became futile and ultimately they got exhausted and died.

(ii) *Abrasion of the cuticle.*—The soil in Aindhar (25° 24′ N 49° 42′ E) consists of coarse sand and fine gravel. The particles of sand and gravel are blown up by the strong wind which hits very hard. This constant hitting of particles of sand and gravel caused abrasion of the cuticle of hoppers and thus killed them. It was observed that freshly moulted hoppers died quicker.

(iii) *Starvation.*—As the storm continued for 72 hours the hoppers which had taken shelter beneath the bushes could not feed for a long time and thus died of starvation.

(iv) *Desiccation.*—The constant blowing up of high velocity wind caused desiccation and ultimate death of hoppers.

Summary

While carrying out control operations against hoppers of the desert locust (*Schistocerca gregaria* Forsk) in Saudi Arabia, it was found that wind storm was responsible for exposure of eggs and mortality of II and III instar hoppers. The main factors responsible for mortality of hoppers were exhaustion, abrasion of cuticle, stravation and desiccation.

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THE MUSTARD APHID AND ITS CONTROL WITH MODERN INSECTICIDES

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Lipaphis erysimi (Kaltenback), popularly known as mustard aphid, is one of the most destructive and widely distributed pests of cruciferous plants like mustard, radish, turnip, knolkohl, cabbage, cauliflower, spinach, lettuce and other crops and also wild shrubs of *Brassica* family. It has also been recorded on tobacco and potato. Krishnamoorthi (1928) found this specie in association with *Myzus persicae* on tobacco and cabbage in Mysore.

The mustard aphids are about 1/10 of an inch long and whitish green in colour. Generally they make their appearance in November and December in Delhi when the mustard seedling plants have already come up in the fields. The flower-stalks, tender twigs and leaves are usually heavily infested and dense clusters of these aphids are often found on the lower portions of the pods. The affected leaves curl and crinkle or sometimes form cuplike depressions in which the aphids are found in large numbers. Sometimes they are found densely covering the inflorescences. In case of severe infestation, the plants wilt and die. Generally the infested plants, if not killed, are dwarfed and have curly and discoloured leaves, giving an unhealthy appearance. These aphids secrete honey dew, which attracts ants, bees and flies to the infested plants. Besides, a black mould develops on badly infested plants, giving them a black and blighted appearance.

According to Narayanan (1958), the mustard aphid makes its first appearance sometimes in November and causes extensive damage to various cruciferous crops upto April. The damage starts with mustard, subsequently spreading over to radish, cabbage, knolkohl, etc. No sexual forms have so far been recorded in Delhi and surrounding areas. They reproduce asexually as a rule. Asexual reproduction has also been observed in Mysore and other places in the south. The first females that appear on the crop are known as stem-mothers. They produce tiny, living, young ones which mature within a week or so and produce again more young ones. These multiply asexually, generation after generation, in geometrical progression. When mustard is harvested, they take to cabbage, cauliflower or any other cruciferous crop that is left in the field. When summer approaches a generation of winged adults is produced. These establish small colonies on plants growing in cold moist places. Sometimes these winged adults migrate to the hills from where they return to plains when mustard crop is again in

the field. The winged aphids fly about in the warm evenings in February and the beginning of March. In Delhi the author had noticed the winged adults so numerous during February and early March, 1954, that there were large numbers of migratory swarms which were a big nuisance to the people going on the roads. They used to settle on them and sometimes get into their mouths and nostrils. Ullah (1940) had also reported that in 1937 they were so abundant in Delhi and the adjoining areas that there were large swarms of winged adults in the months of February and March. Several overlapping generations are present during the period from November to March. It has been observed that cloudy and moist weather is very conducive to the rapid multiplication of the pest in the plains.

CONTROL MEASURES

Inspite of the fact that the pest is kept under check both by physical factors like severe wind, rain and fluctuating temperatures and biological factors like parasites and predators, notably grubs and adults of lady bird beetles, maggots of syrphid flies and the larvae of chrysopids, it destroys mustard and other cruciferous vegetables every year.

For successful protection of these cruciferous crops, exposed to the attack of this notorious pest, the plants should be in a state of rapid growth; planting them in rows facilitate the application of insecticides, permits good cultivation, conserves the soil moisture, stimulates plant growth and hastens maturity. The crops should be harvested completely as soon as they are ready for the market and all refuse should be ploughed under immediately.

Clean cultivation, destruction of all weeds serving as alternate hosts in the vicinity of the field and aphid infested shoots of the crop, dusting the crop with 1 to 4% nicotine or 0.5 to 0.75% rotenone dust at the rate of 15 to 20 lbs. per acre or spraying the crop with rosin soap (1 lb. in 5 gallons of water), Nicotine sulphate (1 lb in 80 gallons of water), 0.1% BHC emulsion and 0.05% malathion have been recommended by earlier workers for the control of this pest.

The author, while working at Delhi as Technical Assistant in the Directorate of Plant Protection, Quarantine & Storage, tried a few modern insecticides against this pest on mustard in a village called Bavana to assess their comparative efficacy with a view to find out the cheapest and the best insecticide for the effective control of this pest.

0.04% parathion (1 lb. in 114 gallons of water), 0.1% G24125 (supplied by M/s. Geigy Company) (1 lb. in 100 gallons of water), 0.005% pyrocolloid (pyrethrum) (1 lb. in 60 gallons of water), 0.2% DDT emulsion (1 lb. in 12½ gallons of water), 0.05% nicotine (1 lb. in 80 gallons of water) at the rate of 60 gallons per acre, and Geigy vegetable dust containing 0.65% pure *gamma* BHC, 5% DDT dust, and 5% BHC dust at the rate of 15 lb. per acre were tried. Parathion,

pyrocolloid and DDT emulsion gave 100% kill of the pest within 48 hours. G 24125 and nicotine gave 93% and 90% kill respectively. Among the dusts used, Geigy vegetable dust proved better than 5% DDT dust and 5% BHC dust since it gave 89% kill while DDT and BHC dusts produced only 60% and 59% mortality respectively.

The approximate costs of insecticides used are given below:—

	Rs.
1. 60 gallons of 0.04% parathion	7.75
2. 60 gallons of 0.005% pyrocolloid	16.96
3. 60 gallons of 0.2% D.D.T. emulsion	6.60
4. 60 gallons of 0.1% G 24125	Not known
5. 60 gallons of 0.05% nicotine	6.75
6. 15 lb. of Geigy vegetable dust	8.55
7. 15 lb. of 5% D.D.T. dust	5.55
8. 15 lb. of 5% BHC. dust	2.75

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LIST OF INTERCEPTED PLANT PESTS

By

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A list of plant pests intercepted on, in or with imported plant materials during 1955-58, was published in *Plant Protection Bulletin* Vol. X, Nos. 1-4 January-December, 1958. Another list of intercepted plant pests is now being published. This list provides information about hosts or carrier, plant pest and the country of origin. All these pests were intercepted at the Plant Quarantine & Fumigation Station at Bombay during 1959. Every effort has been made to give the correct identification and origin for all the pests intercepted. In many cases the specific name of the pest could not be determined.

Host/Carrier	Plant Pest	Name of the family to which the pest belongs	Country of Origin
1	2	3	4
Begonia . . .	*Alaeochara sp.*	Staphylinidae	Muscat.
Gladiolus . . .	*Alaeochara sp.*	Staphylinidae	
Flower bulbs . .	*Alaeochara sp.*	Staphylinidae	
Peach . . .	*Carpophilus dimidiatus* Fab.	Nitidulidae	Pakistan.
Cycas leaves . .	*Carpophilus* sp.	Nitidulidae	Switzerland & Ceylon.
Date Palm . .	Do.	Do.	Muscat.
Peach . . .	Do.	Do.	Pakistan.
Date Palm . .	*Carpophilus hemipterus* L.	Do.	Muscat.
Pomegranate . .	*Carpophilus hemipterus* L.	Do.	Do.
Gladiolus . . .	Do.	Do.	Do.
Gladiolus bulbs .	*Carpophilus hemipterus* L.	Do.	Do.
Apple . . .	*Carpophilus* sp.	Do.	Pakistan.
Pomegranate .	*Carpophilus mutilatus* Er.	Do.	Do.
Date Palm . .	*Carpophilus humeralis* F.	Do.	Muscat.
Grapes . . .	*Carpophilus obsoletus* Er.	Do.	Pakistan.
Cotton seed . .	*Oryzaephilus mercator* Fauv.	Cucujidae	U.S.S.R.
Grape . . .	*Typhaea stercorea* L.	Mycetophagidae	Pakistan.

1	2	3	4
Rose plants . .	*Anastaena* sp.	Hydrophilidae	U.K.
Soil . . .	*Phyllophaga* sp.	Melolonthidae	Iran.
Apple . . .	*Laspeyresia pomonella* L.	Eucosmidae	Pakistan.
Cotton seed . .	*Tribolium conusfum* Duv.	Tenebrionidae	U.S.S.R.
Pomegranate . .	Do.	Do.	Pakistan.
Apple root Stock .	*Alphitobius laevigatus* F.	Do.	U.K.
Begonia . . .	*Alphitobius laevigatus* F.	Do.	Muscat.
Soil . . .	*Otiorrynchus* sp.	Curculionidae	Switzerland.
Rose cuttings . .	*Rhynchaenus* (*Orchestes*) *rusci* Host.	Do.	U.K.
National aircraft .	*Caryedon gonagra* F.	Bruchidae	U.S.A.
Cotton seed . .	*Cephalonomia tarsalis* Ashm.	Bethylidae	U.S.S.R.
Orchid . . .	*Technomyrmex detorduens* walker.	Formicidae	Singapore.
Date Palm . .	*Paratrechina* sp.	Do.	Muscat.
Fig Plant . . .	*Myrmecina* sp. *striata* Em.	Do.	Iran.
Cycas sp. cone . .	*Eurytoma* sp.	Eurytomidae	Ceylon.
Date Palm . .	*Arenipses sabella* Hmps.	Pyralidae	Muscat.
Cotton seed . .	*Ephestia cautella* Walk.	Do.	U.S.S.R.
International aircraft .	*Scatope* sp. *fusicipes* Mg.	Scatopsidae	Nairobi.
Potatoes . . .	*Megaselia* sp.	Phoridae	Australia.
Potatoes . . .	*Phora* sp.	Do.	Do.
Gladiolus . . .	*Musca* sp.	Muscidae	..
Peach . . .	*Dacus* sp. (*cucurbitae* coq.)	Trypetidae	Pakistan.
Apple . . .	*Ceratitis capitata* Wied.	Do.	Do.
International aircraft	*Nysius* sp. nr. *cymoides* spin.	Lygaeidae	U.K.
Daffodils . . .	*Triphleps* sp.	Anthocoridae	Nairobi.
International aircraft	*Circulifer dubiosus* (Mats.)	Cicadellidae	U.K.
Chrysanthemum .	*Aphis gossypii Glover* groups	Aphididae	Nairobi.
Orchid cut flowers .	Do.	Do.	Thailand.
Tulip cut flowers .	Do.	Do.	Netherland.
Anemone cut flowers .	*Myzus persicae* Sulzer	Do.	Do.
Orchid cut flowers .	*Dichromothrips corbetti* Pr.	Thripidae	Thailand.

1	2	3	4
Daffodils . . .	*Taeniothrips simplex* Mor.	Thripidae	Pakistan.
Cut flowers . .	*Entomobrya nivalis* (*Linn.*)	Entomobryidae	Netherland.
Cut flowers . .	*Agyneta* sp.	Linyphiidae	Do.
Wheat & Paddy .	*Diaea dorsata* (Fabr.)	Thomisidae	U.S.S.R.
Fig plant . . .	*Pachylaelaps* sp.	Pachylaelaptidae	Do.
Fig plant . . .	*Parasitus* sp.	Parasitidae	Iran.
Soil . . .	*Allothrombium* sp.	Thrombidiiae	Switzerland.
Rose plant . .	*Proteroiulus fuscus* (Am Stein).	Blaniulidae	U.K.
Gladiolus . . .	*Porcellio* sp.	Porcellionidae	Muscat.
Date Palm . .	*Metoponorthus pruinosus* (Brandt).	Do.	Do.
Citrus trees . .	*Agabiformius pulchellus* (Dollfus).	Do.	..
Fig plant . . .	*Roncus* (*Ronchus*) *corimanus* Beier.	Cheliferidae	Iran.
Date Palm . .	*Strobilochelifer*	Do.	Muscat.
Malta-orange .	*Chrysomphalus ficus* Ashm.	Coccidae	Pakistan.
Mangosteen . .	*Aspidiotus* sp. *destructor* Sign.	Do.	Ceylon.
Pine Apple . .	*Dysmicossus brevipes* (Ckll.)	Do.	Ceylon.
Plum . . .	*Parlatoria oleae* (Colvee)	Do.	Pakistan.
Apple . . .	*Ferrisiana virgata* (Ckll.)	Do.	Do.
Date Palm . .	*Pseudaspidoproctus hyphaeniacus* (Hall)	Do.	Muscat.
Malta-orange . .	*Aonidiella citrina* (Coq.)	Do.	Pakistan.

COMMON NAMES OF PESTICIDES

A large number and variety of chemicals are being marketed and used in India and elsewhere for controlling or mitigating pests and diseases of agricultural, veterinary and public health importance. Most of these chemical pesticides are sold under proprietary or trade names and in several instances the same pesticide is marketed under different proprietary or trade names without any indication of its chemical composition. Moreover, the chemical names of the large majority of such pesticides are too long and complex to be remembered and referred to as such in daily use even by technical personnel, not to mention field workers, cultivators and other laymen. In order to help in easily identifying and naming pesticides and to simplify and standardise their nomenclature at national and international levels, the Indian Standards Institution and similar organisations in other countries as well as the International Standards Organisation have adopted suitable common names for pesticides, which are being widely used by various official and non-official agencies connected with plant protection and also by research workers and extension personnel in their publications and other media of communication.

In India, Government departments and official agencies generally avoid using proprietary or trade names of pesticides in their publications, recommendations and reports. The accepted common names for various pesticides do not appear to be well known to many. In order to popularise the use of common names the Directorate of Plant Protection, Quarantine & Storage has compiled a list of Common names of pesticides, which is being published here. The list gives the chemical names of pesticides and the common names approved by recognised organisations such as the British Standards Institute, Indian Standards Institution, the Food & Drug Administration, U. S. Department of Health, Education & Welfare and the Entomological Society of America.

Additions and amendments will be issued from time to time.

Common Name	Chemical Name
allethrin	allyl homolog of cinerin I
aldrin	1:2:3:4:10:10-hexachlore-1:4:4a:5:8:8a-hexahydro-1:4:5:8-dimethanonaphthalene.
antu	∝-naphthyl thiourea.
aniton exalate	O,O,-diethyl S-2-diethylanincethyl phosphorothioate hydrogen exalate.
azobenzene	azobenzene.
ammonia	ammonia.
benzene hexachloride (BHC)	1,2,3,4,5,6-hexachlorocyclohexane.
gamma BHC	gamma isomer of BHC.

Common Name	Chemical Name
biphenyl (diphenyl)	2-(p-tert-butylphenoxy)-isopropyl-2-Chloroethyl sulfite.
barthrin	6-chloropiperonyl chrysanthemumate.
butoxy polypropylene glycol	butoxypropanediol polymer.
calcium arsenate	calcium arsenate.
calcium cyanide	calcium cyanide.
captan	N-trichloromethyl mercapto-4-cyclohexene-1, 2-dicarboximide.
carbon disulfide	carbon disulfide.
carbon tetrachloride	carbon tetrachloride.
chlorbenside	P-chlorobenzyl p-chlorophenyl sulfide.
Chlorobenzilate	ethyl, 4,4-dichlorobenzilate.
chlordane	1,2,4,5,6,7.8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4, 7-methanoindene.
chloropicrin	trichloronitromethane.
coumachlor	3-(a-acetonyl-4-chlorobenzyl-4-hydroxy-coumarin).
CIPC	isoprophyl N(3-chlorophenyl) carbonate.
copper arsenate	copper arsenate.
copper carbonate (basic)	basic copper carbonate.
copper compounds	Bordeaux mixture, copper acetate, copper lime mixture, copper oxy-chloride, copper silicate, copper sulfate (basic) etc.
cyclethrin	3-(2-cyclopenten-1-yl)-2-methyl-4-oxo-2-cyclopenten-1-yl-chrysanthemumate.
chloroform	chloroform.
chlortetracycline	chlortetracycline.
chlorfenson	p-chlorophenyl p-chlorobenzene-sulphonate.
chloropropham	isopropyl N-p-chlorophenyl carbamate.
DDT	a mixture of 1,1,1-trichloro-2,2-bis (p-chlorophenyl) ethane and 1,1,1-trichloro-2-(O-chlorophenyl)-2-(p-chlorophenyl) ethane.
pp DDT	1:1:1-trichloro-2:2-di (p-chlorophenyl) ethane.
demeton-O	O,O-diethyl O (2-(ethylthio) ethyl) phosphorothioates.
fumazone	1-2-dibromo-3-chloropropane.
demeton-O-methyl	O-(3-(ethylthio) ethyl) O, O-dimethyl phosphorothioate.
demeton-S	O,O-diethyl-S-(2-(ethylthio) ethyl) phosphorothioate.
demeton-S-methyl	S-(2-(ethylthio) ethyl) O, O-dimethyl phosphorothioate.

Common Name	Chemical Name
diazinon	O, O-diethyl O-(2-isopropyl-6-methyl)-4-pyrimidinyl) phosphorothioate.
dinex	2-cyclohexyl-4, 6-dinitrophenol.
dinosam	2-(1-methyl-n-butyl)-4, 6-dinitrophenol.
dichlone	2,3-dichloro-1, 4-nephthaquinone.
dimefox	bis (dimethylamino) fluorophosphine oxide.
dinosob	2-(1-methyl-n-propyl)-4,6-dinitro-phenol.
dieldrin	1:2:3:4:10:10-hexachloro-6:7-epoxy-1:4:4a:5:6:7:8:8a-octahydro-1:4:4:8-dimethano-naphthalene.
DNC-DNOC	3:5-dinitro-o-cresol.
diuron	3-(3, 4-dichlorophenyl)-1, 1-dimethylurea.
2, 4-D	2-4-dichlorophenoxy acetic acid.
DDVP	2, 2-dichlorovinyl dimethyl phosphate.
dicapthon	O-(2-chloro-4-nitrophenyl)O, O-dimethyl phosphorothioate.
dichloroethylether	bis (2-chloroethyl) ether.
diethyltoluamide	N, N-diethyl-m-toluamide.
dimetan	dimethyl 5,5-dimethyl-3-oxo-1-cyclo-hexen-1-yl carbamate.
dimethoate	O,O-dimethyl S-(N-methylcarbamoyl-methyl) phosphorodithioate.
dimethyl carbate	dimethyl cis-bicyclo(2.2.1) hept-5-ene-2,3-dicarboxylate.
dodine	N-dodecylguanidine acetate.
dinoprop	2-isopropy-4:6-dinitrophenol.
endrin	1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy-1 4, 4a, 5, 6, 7, 8, 8a-Octahydro-1, 4-endo endo-5, 8-dimethanonaphthalene.
EPN	O-ethyl, O-p-nitrophenyl benzene thio-phosphonate.
ethion	O, o, o′, o′,-tetraethyl S, S′-methylene bis-phosphorodithioate.
ethoxyquin	1,2-dihydro-6-ethoxy-2, 2, 4-trimethyl-quinoline.
ethylene	ethylene.
ethylene dibromide	ethylene dibromide.
ethylene oxide	ethylene oxide.
ethyl hexanediol	2-ethyl-1, 3-hexanediol.
ethylene dichloride	ethylene dichloride.
ferbam	ferric dimethyldithiocarbamate.
ferrous sulphate	ferrous sulfate.

Common Name	Chemical Name
fluorine compounds	cryolite, sodium or aluminium fluoride.
furethrin	3-furfuryl-2-methyl-4-oxo-2-cyclo-penten-1-yl chrysanthemumate.
fenson	p-chlorophenyl benzenesulphonate.
glyodin	2-heptadecyl glyoxalidine acetate
HEOD	1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy 1, 4,4a, 5,6,7,8, 8a-Octahydro. exo-1, 4-endo-5, 8-dimethanonaphthalene.
heptachlor	1, 4, 5, 6, 7, 8, 8-heptachloro-4-7-methano-3a, 4, 7, 7a-tetrahydroindene.
HETP	hexaethyl tetraphosphate.
HCN	hydrogen cyanide.
HHDN	1:2:3:4:10:10-hexachloro-1:4:4*a*:5:8:8*a*:-hexahydro-exo-1:4-endo-5:8-dimethano-naphthalene.
isodrin	1, 2, 3, 4, 10, 10-hexachloro-1. 4. 4a. 5, 8. 8a-hexahydro-1, 4-endo-endo-5, 8-dimetha-nonaphthalene.
lead arsenate	lead arsenate.
lime	calcium oxide.
lime sulphur	calcium polysulfide, water, free sulfur, calcium thiosulphate mixture.
lindane	gamma isomer of benzene hexachloride.
lauseto neu	chloromethyl p-chlorophenyl sulfone.
malathion	S-(1,2-Bis (ethoxycarbonyl ethyl)O,O-dime-thyl-phosphorodithioate
mazidox	bis (dimethylamino) ozide phosphine oxide.
mipafox	Bis (monoisopropylamino) fluorophos-phine oxide.
methoxychlor	1, 1, 1-trichloro-2, 2-di-p-methoxyphenyl-ethane.
MCPA	4-chloro-2-methylphenoxy acetic acid.
maneb	manganese ethylene-1, 2-bisdithio-carba-mate.
magnesium arsenate	magnesium arsenate.
maleic hydrazide	1, 2-dihydro-3, 6-pyridazinedione.
mercury containing compounds	1-methoxycarbonyl-1-propen-2-yl-dime-thyl phosphate and its beta isomer.
methyl bromide	methyl bromide.
methylene chloride	methylene chloride.
methyl parathion	O, O-dimethyl O-P-nitrophenyl thio-phosphate.
mineral oil	refined petroleum oil.
monuron	3(p-chlorophenyl)-1, 1-dimethylurea.
medlure	sec-butyl 4(or 5)-chloro-2-methylcyclo-hexane carboxylate.

Common Name	Chemical Name
nabam	disodium ethylene-1, 2-bisdithio-carbamate.
naphthalene acetic acid	naphthalene acetic acid.
nicotine-containing compounds	nicotine sulphate and others.
ovex	p-chlorophenyl-p-chlorobenzene sulphonate.
oxytetracycline	oxytetracycline.
parathion	O, O-diethyl O-P-nitrophenyl thiophosphate.
probham	isopropyl-N-phenyl carbamate.
proxan-Na	Sodium isopropyl n xanthate.
Pentane	pentane.
petroleum oil	..
phenothiazine	thiodiphenylamine.
piperonyl butoxide	(butyl carbityl) (6-propyl piperonyl) ether.
piperonyl cyclonene	mixture of 3-alkyl-6-carbethoxy-5-(3, 4-methylene-dioxyphenyl) 2-cyclohexene-1-one and 3-alkyl-5-3-4-methyl-enedioxyphenyl)-2-cyclohexene-1-one.
potassium polysulfide	potassium polysulfide.
pyrethrins	insecticidally active principles of *Chrysanthemum cinerariaefolium.*
n-propyl isomer	dipropyl 5, 6, 7, 8-tetrahydro-7-methyl-naphtho (2,3)-1, 3-dioxole-5, 6, dicarboxylate.
para-oxon	diethyl p-nitrophenyl phosphate.
Phosphamidon	1-chloro-1-diethycarbamoyl-1-propen-2-yl dimethyl phosphate.
propyl isome	dipropyl 5, 6, 7, 8-tetrahydro-7-methylnaphtho (2, 3)-1, 3-dioxole-5, 6-dicarboxylate.
phonate	O, O-diethyl S-(ethylthio) methyl phosphorodithioate.
ronnel	O, O-dimethyl O-(2, 4, 5 -trichlorophenyl) phosphorothioate.
rotenone or derris or cube roots	..
ryania	ryania.
schradan	Octamethylpyrophosphoramide.
sulfotep	bis-O, O-diethylphosphorothionie snhydride.
sabadilla	sabadilla.
selenium and selenium compounds	..
sesone	2, 4-dichlorophenoxyethyl sulphate.
sodium arsenate	sodium arsenate.
sodium carbonate	Sodium carbonate, sodium dehydroacetate sodium 2, 4-dichlorophenoxyacetate, etc.
sodium metabisulphite	sodium metabisulphite, Sodium-O-phenylphenate.

Common Name	Chemical Name
sodium polysulphide	sodium polysulphide.
sodium propionate	sodium propionate.
sulphur	sulphur.
sulphur dioxide	..
sesamex	2-(2-ethoxyethoxy) ethyl 3, 4-methylene-dioxyphenyl acetal of acetaldehyde.
sesamin	2, 6-bis (3, 4-methylenedioxyphenyl)-3-7-dioxabicyclo (3.3.0) octane.
sesamolin	2-(3, 4-methylen dioxyphenyl)-6-(3,4-methylenedioxy-phenoxy)-3, 7- dioxabicyclo (3.3.0.) octane.
siglure	sec-butyl 6-methyl-3-cyclohexene-1-carboxy late.
sulfoxide	1, 2-methylene dioxy-4-2-(octylsulfinyl) propyl benzene.
toxaphene	Chlorinated camphene (67-69% chlorine).
thiram	bis (dimethyl Thiocurbamyl) disulphide.
2,4,5-T	2-4-5-trichlorophenoxy acetic acid.
tecnazene	1, 2, 4, 5-tetrachloro-3-nitrobenzene.
TEPP	tetraethyl pyrophosphate.
TDE	1, 1-dichloro-2, 2-bis (p-chlorophenyl) ethane.
Tartar emetic	potassium antimonyl tartrate.
terpene polychlorinate	terpene polychlorinates containing 65-66% chlorine.
warfarin	3-0 (-acetonylbenzyl -4-hydroxy-coumarin.
zineb	zinc ethylene bis (dithiocarbamate).
ziram	zinc dimethyl-dithiocarbamate.

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SHORT NOTES

Mediterranean Fruitfly Interception at Bombay

The notorious friutfly pest, *Ceratitis capitata* Wied., popularly known as the Mediterranean fruitfly, was intercepted at Bombay (Santa Cruz) airport in 1958 and again in 1959. These interceptions further emphasize the importance of continued vigilance and adoption of plant quarantine measures at our seaports, airports and land frontiers.

The Mediterranean fruitfly is a serious pest and attacks many citrus and deciduous fruits, including oranges, grapefruit, peaches, plums, apples, pears and nearly hundred other cultivated and wild fruits. It occurs in many countries of Europe, particularly those around the Mediterranean sea, and in parts of West Asia, Africa, Australia and South America and in Hawaii and Bermuda. It is not known to occur in the territories of the South East Asia and Pacific Region as defined in the Plant Protection Agreement for the South East Asia and Pacific Region, sponsored by the FAO in 1956. Under this Agreement, to which India is a signatory, all contracting Governments have to take effective measures to exclude from the Region crop pests and diseases not known to occur therein. Plant quarantine measures in India are enforced under the provisions of the Government of India's Destructive Insects and Pests Act, 1914.

The Mediterranean fruitfly was found to be present in Florida (U. S. A.) in April 1929 and immediately a strict quarantine preventing the movement of citrus fruits out of that State was enforced and by wholesale destruction of all orange, lemon and grapefruit, both fallen and on the trees, in the infested area and spraying of trees of all kinds the pest was completely eradicated, involving an expenditure of over 7 million dollars of federal and State funds. The pest was again detected in Florida in April 1956 and another eradication campaign was immediately launched and an area of 7·25 lakh acres was treated with malathion-protein baits at a cost of over 10 million dollars.

Active maggots of the Mediterranean fruitfly were intercepted in consignments of apple coming by air as accompanied baggage from Karachi. Several maggots were intercepted in 1958 and five in 1959.

The pest was identified by the Commonwealth Institute of Entomology, London.

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7—3 F. & A./63

APPEARANCE OF *GUNDHY BUG* IN MADHYA PRADESH DURING 1959.

Paddy is an important crop of Madhya Pradesh and is in fact the principal cereal crop. The area under paddy (according to figures available for 1956-57) is roughly 9·5 million acres and the production is 3·13 million tons. *Leptocorisa varicornis* Fb., popularly called *gundhy bug*, is one of the important pests of paddy.

This pest appeared in some 5 districts of Rewa Division, viz. Satna, Rewa, Panna, Sidhi and Shahdol in the first week of September, 1959, and the first report of the appearance of the pest was received on the 17th September, 1959. The incidence of the pest was low and the attack sporadic in nature. From a survey undertaken by the Plant Protection staff of the State Department of Agriculture in collaboration with the Central Plant Protection Station, Indore, it was found that the pest occured in scattered localities and was confined to some pockets here and there. There was no large scale epidemic outbreak of the pest. The damage caused was also negligible. In some localities, however, damage to early sown paddy was roughly 10%. The late sown paddy was, generally speaking, free from the attack of the pest.

The cultivators of this region are very conscious of the need of speedy control of the pest on account of heavy losses which the pest can cause in case it is allowed to go unchecked. Hence immediate control operations were undertaken simultaneously in all the affected districts. The crop was dusted with 5 or 10% BHC at 20 lb. per acre and 12 lb. per acre respectively, using hand dusters. Apart from controlling the pest, some cultivators also got their paddy treated as a protective measure. Some 20 tons of BHC (5% and 10%) dust was available in these districts when the control operations were started in the beginning of 3rd week of September, 1959. Arrangements were also made by the State Entomologist, to procure another 15 tons from Bombay. Control operations were continued up to 28th October, 1959 and during this period about 4,500 acres were dusted using 35 tons of BHC dust.

The Central Plant Protection Station at Indore loaned 90 hand dusters for the duration of the campaign . In addition, one Technical Assistant and one Junior Technical Assistant were deputed from the Central Plant Protection Station at Bilaspur and one Technical Assistant was deputed from Indore to assist the State Department of Agriculture in surveying the affected localities and organising control operations against the pest.

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MACROPHOMA ON CITRUS

This note brings to light a species of *Macrophoma* on citrus, hitherto not known to occur in India, which was intercepted at the Plant Quarantine & Fumigation Station, Bombay.

During September, 1951, a consignment of citrus budwood cuttings was received at Bombay from Paris by air. The source of these cuttings was the Central Station at Faulaya, French Guinea, of the Institue Des Fruites at Agrumes Coloniaux, Rue du general clergerie. Out of a total of 36 bundles of different varieties of citrus budwood received for inspection at this station, one bundle was diseased. The consignment was not accompanied by a phytosanitary certificate as required under rules of the Destructive Insects and Pests Act, 1914. In view of this and the fact that the plant material revealed the presence of a serious and apparently new disease the consignment was destroyed.

All the five cuttings were covered with numerous pycnidia. These varied from small, brown, immature to large, fully mature, black or carbonaceous ones. They were globose, more or less sunken in the substratum, ostiolate, tending to be erumpent on maturity. Conidiophores were simple, short, filiform and hyaline. Conidia or pycnidiospores were borne singly; they were large, mostly elliptical, sometimes oval, unappendaged, hyaline, non-septate or continuous, with somewhat granular contents, measuring 24.2 to 30.8 microns by 11.8 to 14.3 microns (mean 26.84 × 13.24 microns).

Five species of *Macrophoma* have been recorded on citrus : *M. citri* Celotti on twigs of *Citrus triptera* Desf. from Montpellier, France (4); *M. kuwatsukaii* Hara causing storage rot of orange from China (6); *M. aurantia* Scalia on leaves of *Citrus sinensis* L. from Italy (2); *M. mantegazziana* (Penz.) Berl. & Vogl. on leaves of *Citrus* sp. from Brazil (1) and Ceylon (2) and *M. paraphysata* Speg. on dead branches of orange from Paraguay (5).

Species	Host and Parts affected	Spore dimension in microns
M. mantegazziana . .	Mostly on leaves, rarely on branches of *Citrus medica* and *Citrus* sp.	19 to 22 × 4 to 5
M. aurantii . . .	Leaves of *Citrus aurantii* . .	21 to 33 × 7·5 to 9
M. citri . . .	Branches of *Citrus triptera* (*Poncirus trifoliata*).	25 to 28 × 8 to 10
M. paraphysata . .	Branches of orange . . .	18 to 26 × 12 to 16
Macrophoma sp. intercepted at Bombay.	Cuttings of Citrus sp. . .	24.2 to 30.8 × 11.8 to 14.3 (mean 26.84 to 13·24)

A comparison of spore dimensions of the known species of *Macrophoma* on citrus (see Table) shows that the fungus intercepted at Bombay although not identical with *M. paraphysata* approaches it more closely than any of the other species mentioned therein. In view of these considerations the intercepted fungus is regarded as a variety of *Macrophoma paraphysata*.

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BOOK REVIEW

Hanna's Handbook of Agricultural Chemicals, by Lester W. Hanna, Rt. 1, Box 210, Forest Grove, Oregon, U.S.A., 2nd Edition, 1928, (price not indicated)

With the rapid development of a very large number of new synthetic pesticides over the last two decades or so, the plant protection worker frequently hears or reads about various new chemicals, their toxic properties, current use and potential importance in the control of crop pests and diseases. The second edition of *Hanna's Handbook of Agricultural Chemicals* is a fairly comprehensive reference manual which contains useful information about more than a thousand pesticides and other agricultural chemicals, including fertilizers. The book is divided into 15 chapters, the last of which is followed by an index, a list of selected references and five numbered blank pages for reader's notes. The first 7 chapters include toxicological data on pesticides and *inter alia*, information on official tolerance limits prescribed in the U.S.A., First Aid procedures and anti-dotes for various pesticides, formulae for preparing pesticides solutions of some commonly used concentrations and conversion tables. Chapter 8 deals with fertilizers and chapters 9 to 14 with fumigants, fungicides, herbicides, insecticides, livestock chemicals and rodenticides, respectively. The chapter on insecticides covers acaricides also. The information furnished for each pesticide includes the chemical name or formula, trade name(s), if any, the pests or diseases against which it has been or can be used, precautions to be observed in handling and using and the anti-dotes prescribed in the case of the more toxic materials. The last chapter provides valuable information about various miscellaneous items, arranged alphabetically, such as aerosols, biological control of insect pests, electronic insect control, forest entomology, effects of insecticides on honey bees, radio active isotopes, viruses, etc.

The book runs to 489 pages, excluding the blank pages. There are two excellent coloured charts, one on spray compatibility and the other on weather factors in spraying and dusting. In the index the various chemicals dealt with are listed in groups such as fertilizers, fumigants, insecticides, etc.

The book should prove immensely useful to plant protection workers, extension officials, agricultural students and others.

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